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# BMJ Open

## **"Gut health" and the microbiome in the American and Canadian popular press: A content analysis**

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-052446
Article Type:	Original research
Date Submitted by the Author:	15-Apr-2021
Complete List of Authors:	Marcon, Alessandro; University of Alberta, Health Law Institute; Turvey, Stuart; British Columbia Children's Hospital Caulfield, Timothy; University of Alberta, Faculty of Law
Keywords:	MICROBIOLOGY, PUBLIC HEALTH, QUALITATIVE RESEARCH

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## Title Page

**Article Title:** “Gut health” and the microbiome in the American and Canadian popular press: A content analysis

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**Word Count:** 3,380

**Abstract**

**Objective**

Extensive research and important discoveries on the microbiome has led to a growth in media coverage. This study explores how the microbiome has been portrayed in press sources popular among American and Canadian audiences.

**Design**

Content analysis.

**Methods**

Using the FACTIVA database, we compiled a finalized dataset of (N=830) articles from press sources popular among American and Canadian audiences which were published between January 1, 2018- August 23, 2019 and which contained at least one of the following search terms: “microbiome”, “microbiota”, “gut health”, “healthy gut”, “unhealthy gut”, “gut bacteria”, “probiotic” or “probiotics.” We performed content analysis on the articles to determine how often ideas of the microbiome were presented as beneficial, in which health contexts, and whether actions could be taken to reap stated benefits. We compared this portrayal of benefits with critical portrayals of the microbiome.

**Results**

Almost all of the articles (94%) described health benefits associated with the microbiome with many (79%) describing actions which could be taken to reap stated benefits. Articles most often described health benefits in more broad, general context (34%) and most commonly outlined actions related to food/drug (45%) as well as probiotic (27%) intake. Only some articles (19%) provided microbiome-related critiques or limitations. Some of the articles (22%) were focused on highlighting specific research developments, and in these articles, critiques or limitations were more common.

**Conclusions**

Articles discussing the microbiome published for American and Canadian audiences typically hype the microbiome’s impact and popularize gut health trends while only offering a little in the way of communicating microbiome science. Lifestyle choices including nutrition, taking probiotics, stress management, and exercise are often promoted as means of reaping the microbiome-related health benefits. The trend of actionable “gut health” is foregrounded over more evidence-based descriptions of microbiome science.

## Strengths and limitations of this study

- The study included a large data set of microbiome-related articles from media sources popular among Canadian and American audiences.
- Analysis was able to provide a detailed examination of how ideas around the microbiome are being portrayed for audiences
- The data set represented only one kind of media output (articles in the popular press)
- The data set represented only English-language media

## Introduction

The term microbiome (derived from the Greek for ‘small life’) encompasses the microbial community that lives in and on our bodies, as well as the genes these microorganisms express and their metabolic activity. Over the past decade technological advances in genetic sequencing have greatly accelerated our understanding of the human microbiome in health and disease. Fueled by extensive research, important discoveries about the microbiome have steadily increased resulting in a growth in coverage by the popular media.<sup>1,2,3,4,5,6</sup> Researchers have been examining the roles that diverse microorganisms play in shaping our environments and impacting our health.<sup>7,8</sup> This includes exploration of how the microbiome may influence, for example, risk of obesity,<sup>9</sup> cancer<sup>10</sup> mental health outcomes,<sup>11,12</sup> and cardiometabolic and chronic disorders.<sup>13</sup> Other research has been investigating the microbiome’s role in childhood asthma<sup>14,15,16</sup> as well as the how the use of antibiotics alter gut microbiota.<sup>16,17,18</sup> Currently, however, there are only a few microbiome-related interventions in use,<sup>19,20</sup> and critiques have been made around the hyping<sup>21</sup> of gut microbiome’s potential impact in various contexts.<sup>1,4,22,23,24,25,26,27</sup> In particular, critiques have been raised about the exaggerated benefits attributed to probiotics.<sup>28,29,30</sup>

Concerns have also been raised around the popularization and commercialization of microbiome-related research, particularly with regards to its portrayal in the popular press and on social media.<sup>3,4,6,12,22</sup> Searches on Google, for example, yield an extensive assortment of microbiome-related discourse detailing products, therapies, and research developments, including gut makeovers, gut health diets, cleanses, microbiome reboots, probiotic products, skin regimens, cures for disease, and treatments such as colonic hydrotherapy or colonic refluorastation. It was also observed during the COVID-19 pandemic that ideas of gut health circulated often when immune-boosting was discussed.<sup>31</sup> In the case of faecal transplants, for example, while clinical research is progressing and showing signs of promise,<sup>32</sup> there has already been a case of a Canadian naturopath using the procedure to treat children with autism.<sup>33</sup> Research has shown that in context of microbiota-gut-brain (MGB) axis, articles in popular press simplify research and potential health impacts by highlighting “dietary change (including probiotics) as a ‘natural’ means of changing the microbiome, and thus host health status.”<sup>4</sup> Indeed, as noted by Reid, Gadir and Dhir<sup>29</sup> “on a consistent basis scientists, media and industry misrepresent probiotics or make generalized statements that illustrate a misunderstanding of their utility and limitations.”

This project analyzed portrayals of the microbiome in popular English-language news sources for American and Canadian audiences. We mapped out how often, and for which health topics and conditions, microbiome ideas were portrayed as beneficial. We then determine how often, and which actions were presented in order to obtain stated benefits. Lastly, we examined how often ideas of the microbiome were presented critically – that is, whether microbiome benefits or actions were presented as unproven, uncertain, ineffective or exaggerated.

Methods

To examine how the microbiome was portrayed in the popular press, we performed directed content analysis<sup>34</sup> on a rigorously selected sample of articles published in newspaper sources popular among English-speaking American and Canadian audiences.<sup>35</sup> We used the FACTIVA database to search for all articles published on a popular source list between January 1, 2018 and October 11, 2019 (the day of data collection), which contained at least one of the following search terms: “microbiome”, “microbiota”, “gut health”, “healthy gut”, “unhealthy gut”, “gut bacteria”, “probiotic” or “probiotics.” The search terms were chosen to capture microbiome-related media content created for general audiences without excluding the presence of more specific, research-focused content. The terms were finalized after various reviews of sample searches were performed. The timeframe was selected as it was observed through FACTIVA searches and analysis on google trends that the topics of “microbiome” and “gut health” had been steadily receiving media attention from 2010 onwards with no apparent deviations. See Supplementary Materials for search summary.

After the removal of duplicates by FACTIVA, our initial dataset totaled 1395 articles. We then developed a coding frame using the inductive and deductive methods established by our team from previous studies,<sup>36,37</sup> which involve creating an initial coding frame, applying it to a large sample of the data, and modifying it as necessary to accurately capture the reality of the content. The coding frame had three primary objectives: 1) to determine if claims of health benefits were made related to the microbiome (including ideas captured with associated rhetoric, “gut health”, “gut bacteria”, “probiotics”, “microbiota”, etc.), and if so, which health topics these benefits were described in relation to (i.e. allergies, cancer, skin health, general health (“wellness”), etc.); 2) to determine if the article described actions that could be taken to reap the claimed benefits, and if so, what these actions were (i.e. eat certain foods, take probiotics, perform fecal transplants, etc.); and 3) to determine if any benefits or research related to the microbiome might be portrayed as unproven, uncertain, ineffective or exaggerated. Through the sample analysis, specific categories to classify health benefits and related actions were developed, and three further coding categories were established: 1) whether the article’s principal focus was on scientific research, either pertaining to a particular project or summarizing a body of work; 2) whether the article discussed babies or children in relation to the microbiome; and 3) whether an article portrayed taking probiotics as beneficial without describing or connecting that probiotic intake to health benefits associated with the microbiome. See Supplementary Materials for complete coding frame.

During coding, articles that were coded as irrelevant were removed, and the finalized total data set resulted in (N=830) articles. Articles were deemed irrelevant if they were duplicates, incomplete (e.g. a “gut health” headline embedded in an unrelated article), television show transcripts, or

focused exclusively on animal biology or business developments. All articles were coded by two coders who met periodically to discuss any irregularities and reach consensus on disagreements. This process, as outlined and enacted in other research projects,<sup>36,38,39</sup> entailed coders being instructed to flag any articles which posed coding ambiguities, and on each meeting collaboratively coding these uncertainties through discussion and consensus. Once all articles had been coded, each coder performed an audit on a sample of articles coded by the other coder to ensure no significant issues were present.

### Patient and public involvement

This research was done without patient or public involvement. Patients or members of the public were not invited to comment on the study design and were not consulted to interpret the results. Patients or members of the public were not invited to contribute to the writing or editing of this document for readability or accuracy.

## Results

The 830 articles were published in a total of 41 sources of which 143 (17.2%) came from 18 Canadian sources, 244 (29.4%) came from 18 American sources, and 443 (53.4%) came from the 5 sources based in the UK. Of the 830 articles, 439 (52.9%) were published in 2018, and 391 (47.1%) were published in 2019 (before October 11th). In describing the findings, we will use the term “microbiome” as an all-encompassing term for all associated rhetoric.

It was considerably more common for articles to discuss the microbiome in a non-research specific context (n=650, 78.3%) than to focus on specific research (n=180, 21.7%) (Figure 1). In total, 779 articles (93.8%) discussed health benefits in relation to the microbiome. The vast majority (n= 732, 88.2%) did so including (detailed) descriptions of gut health, the microbiome, gut bacteria, etc. while some articles (n=47, 5.7%) did so simply portraying probiotics as beneficial without mentioning “gut health” or the “microbiome.” Articles of this nature, for example, described probiotic-based health regimes of athletes, bars and restaurants offering probiotic health drinks, spas providing probiotic shots, and raw water products containing beneficial probiotics.

Actions one could take to reap the health benefits associated with gut health appeared in n=653, 78.7% of all articles, and 89.2% of all articles that discussed microbiome benefits (Figure 1). Some articles discussed the microbiome in the context of babies or children (n=100, 12%), with approximately half of these 100 articles (n=46) focused on specific research developments. Articles discussing the microbiome in the context of babies or children made up a quarter (25.6%) of all research-focused articles. A total of 156 articles (18.8%) provided critiques, suggesting that either generally or in specific contexts, the health benefits and/or current research of the microbiome might be unproven, uncertain, ineffective or exaggerated (Figure 1).

In total there were more than 135 different health topics for which the microbiome was portrayed as beneficial (See Supplementary Materials for complete list). The health topics most commonly associated with the microbiome are presented in Table 2 and Figure 2. Some topics appearing in fewer than 4.0% of articles included anxiety (n=24, 3.3%), Alzheimer’s disease (n=15, 2.0%),

Parkinson’s disease (n=14, 1.9%), autism (n=12, 1.6%), dementia (n=8, 1.1%), and menopause (n=8, 1.1%). The majority of the articles discussed the microbiome in relation to one health topic (n=455, 62.2%), while 86 (11.8%) connected the microbiome with four or more health topics in the same article. Some singular articles, for example, discussed the microbiome in relation to a wide range of health topics such as allergies, diabetes, obesity, Parkinson’s disease, asthma, autism, Alzheimer’s disease, etc.

The health topic of “general health” was categorized in cases where an article would state, for example, that certain foods were “more beneficial for our gut health than other sources,” that certain foods “maintain a health balance of gut bacteria,” that a particular vitamin product “boosts gut health,” or that helpful health plans could be “built on a person’s gut microbiome.” In cases such as these, there was typically no further reference to what, or how, the microbiome assists, with the articles instead simply stating that “gut health” or the “microbiome” was something valuable and beneficial to one’s health and should therefore be maintained, balanced, strengthened, etc.

Table 2: Health topics where microbiome benefits were portrayed (min 4.0% of articles with health benefits)

Health topics	# of articles	% of total health topics listed (n=1502)	% of total articles (n=830)
General health	284	18.9	34.2
General Digestive/GI Issues	126	8.4	15.2
Immune system related	105	7.0	12.7
Obesity	84	5.6	10.1
Cancer	51	3.4	6.1
General mental health	51	3.4	6.1
Allergies	50	3.3	6.0
Skin Health	46	3.1	5.5
Diabetes	43	2.9	5.2
Depression	42	2.8	5.1
Asthma	36	2.4	4.3
Crohn's/Colitis/Inflam. Bowel Disease	33	2.2	4.0
Mood	32	2.1	3.9
Brain health	30	2.0	3.6
Irritable Bowel Syndrome	30	2.0	3.6
Clostridium difficile	29	1.9	3.5

Of articles describing these microbiome-related health benefits (n=732), the vast majority described actions which could be taken to reap said benefits (n=653, 89.2%). In total there more than 85 unique actions listed in the articles (See Supplementary Materials for complete list). The five most common actions included food/drink intake (n=373, 44.9%), taking probiotics (n=174, 21.0%), avoiding certain foods/drink (n=85, 10.2%) and avoiding antibiotics (n=55, 6.6%). The most common actions are presented in Table 3 and Figure 3. Incorporating the additional articles

which detailed the beneficial qualities of probiotics without making an explicit link to gut health or the microbiome resulted in a total of 221 (26.6%) articles portraying probiotics intake as beneficial (Figure 3). It was not the goal to identify all of the specific foods and drinks listed to improve gut health, but some commonly listed foods included fermented foods such as kombucha, yogurt, kefir, kimchi, etc. as well as lentils, fresh fruit, and vegetables.

The actions of “avoidance” were illustrated both implicitly and explicitly, with implicit cases typically detailing the potentially harmful effects of certain actions. For example, with food avoidance, links were made between artificial sweeteners and unhealthy gut bacteria and their associations with obesity and other diseases. Similarly, negative emotions were linked to being triggered by gut health issues stemming from too much sugar or caffeine. Having caesareans, and thus not having babies exposed to the healthy bacteria of vaginal birth, were portrayed as negatively influencing a baby’s gut microbiome, exposing them to an increased risk of, for example, obesity, asthma, allergies and diabetes. Regarding antibiotics, it was claimed that they could cause, for example, “irreversible damage to crucial gut bacteria,” or that increasing rates of colorectal cancer were potentially a result of altering the gut microbiome with antibiotics.

Table 3: Most commonly mentioned actions that could be taken to reap microbiome health benefits (n=653)

Actions	# of articles	% of total actions listed (n=983)	# of total articles (n=830)
Food/drink intake	373	37.9	44.9
Take probiotics*	174	17.7	21.0
Avoid certain food/drinks	85	8.6	10.2
Avoid antibiotics	55	5.6	6.6
Fecal transplant	37	3.8	4.5
Avoid caesareans	21	2.1	2.5
Stress Management	21	2.1	2.5
Breastfeeding	19	1.9	2.3
Take prebiotics	18	1.8	2.2
Exercise	16	1.6	1.9
Avoid over-sanitation of house	13	1.3	1.6
General actions	13	1.3	1.6
Avoid alcohol	10	1.0	1.2
Supplements	9	0.9	1.1
Fasting	8	0.8	1.0
Sleep	8	0.8	1.0
Spending time outdoors (incl. dirt play)	7	0.7	0.8

\*excluding an additional 47 articles where probiotics were portrayed as beneficial without mentioning gut health ideas.

There was a considerably smaller percentage of articles which stated the health benefits or current research related to the microbiome might be unproven, uncertain, ineffective or exaggerated (n=156, 18.8%). Of these 156 articles, nearly half (n=73, 46.8%) critiqued microbiome developments on the grounds of developments or findings being preliminary research, thereby

noting that research was still developing and, in some cases, that more evidence would be needed to translate findings into practice. The remaining 83 (53.2% of the critical articles, and 10.0% of the total articles) critiqued ideas around the microbiome more broadly, illustrating a lack of scientific evidence and countering perceived hype around the concepts. There were articles, for example, which referenced studies showing how “adjusting the composition of the microbiome is a complex matter,” articles stating that “probiotics are useless,” articles doubting that autism could be treated with “microbes or pills,” or articles casting doubt on the ability of probiotic-rich yogurt to alter vaginal flora.

There were a few notable distinctions between the articles primarily focused on specific research (n=180, 21.7%) and the remaining articles which did not (n=650, 78.3%). First, as previously mentioned, articles discussing the microbiome in the context of babies/children constituted 25.6% of articles focused on research, but were present in only 8.3% of other articles not specifically focused on research. Both research-focused articles and more general articles described health benefits in relation to the microbiome with similar frequency (90.6% and 87.5% respectively), and non-research-specific articles detailed microbiome-related actions (80.9%) only slightly more often than research-focused articles (70.6%). Research specific articles, however, discussed critical perspectives of the microbiome (30.0%) approximately twice as often as general articles (15.7%).

**Discussion**

The findings from this research demonstrate the presence of microbiome hype<sup>3,25,30</sup> in the popular press of American and Canadian audiences. The overwhelming majority of articles (93.8%) either describe health benefits associated with the microbiome or list health benefits associated with taking probiotics. When detailing health benefits, the vast majority of these articles (89.2%) list actions that can be taken to obtain these claimed benefits. As there is demonstrable public interest in the relationship of the microbiome to one’s health, and with considerable interesting research underway, it is unsurprising that numerous health benefits are detailed in articles. Still a weakness in the way this science is being communicated is the fact that less than 19% of the articles suggest that current microbiome science or applications are unproven, ineffective, exaggerated, or requiring more research. This occurs with even less frequency in general articles where the central focus is not detailing specific research. And, as noted in the introduction, despite the abundance of promising research, there are still few microbiome-related clinical applications ready for use.

This research finds the popular press portraying the microbiome as influential in over 135 health conditions/diseases including, digestive issues, obesity, cancer, allergies, skin health, diabetes, asthma, irritable bowel syndrome, and a range of mental health topics including depression, mood, “brain health”, as well as behaviour and ADHD in children. It was linked to discussions of colds, headaches, health during pregnancy, tooth decay, blood circulation, jet lag, eating disorders, sleep, menopause, dementia and athletic performance. *Clostridium difficile*, one of the few ailments for which microbiome treatments are in practice (specifically faecal microbiota transplant or FMT) and supported by evidence<sup>40</sup> is also discussed, but only in a small number of articles (3.5%).

Most often, the benefits of a “healthy gut” are simply presented as a given. Certain foods (e.g., yogurt, kombucha) and particular practices (e.g., taking probiotics) are presented as being

beneficial to “gut health,” though typically no details are provided about why this is so or what the particular health benefits might be. In this regard, the ideas around the microbiome, particularly when expressed as “gut health,” appear oversimplified and function like rhetorical products, signaling and bolstering the microbiome trend, generating attention, attracting readers, and promoting products. This phenomenon, sometimes referred to as a “health halo,”<sup>41</sup> has been similarly observed in other topics like “immune boosting”<sup>31</sup> and in other research on portrayals of the microbiome in the media.<sup>4</sup>

Actions most commonly described to reap the health benefits associated with the microbiome typically focused on lifestyle topics, including nutrition, stress management, general actions (“maintaining”, “strengthening”, “balancing”, “boosting”, etc.), exercise, and sleep. Additionally, health benefits associated with probiotic intake had a large presence in the data set, in 27% of all articles. It was common in these contexts, as well as when promoting fecal transplants and breastfeeding or when problematizing the impact of antibiotic use on the microbiome, to highlight research or take quotes from health care professionals. Research of this precise nature is being conducted in numerous institutions, whereby fecal transplants are showing signs of effectiveness in particular circumstances,<sup>32</sup> and antibiotic intake can negatively influence the microbiome.<sup>42,43,44,45</sup> Further, some lifestyle activities, such as nutrition can play a role in altering the microbiome even though accurately determining the impact remains a challenge.<sup>46,47</sup> In sum, however, while the articles often mention research projects and quote scientists and healthcare practitioners, the overall portrayal of the microbiome science appears to be either oversimplified or greatly exaggerated, serving instead as a means to promote and validate the lifestyle ideas and products contained in the articles. Indeed, less than 19% of all articles provided any critique of the microbiome, with general articles doing so even less frequently (15.7%) than articles focused on specific research developments (30.0%).

Further, in cases where a critique was evident, nearly half (46.8%) portrayed limitations to the microbiome as being simply a case of preliminary research, which may or may not influence how the diverse readership of the popular press interpret the realistic state of the scientific developments.<sup>48,49,50, 51,52</sup> Specifically, it may give a false impression of a potential applications’ readiness, for example, in cases of the microbiome’s influence on autism or mental health.<sup>4</sup> The hyping of science, however, typically involves numerous participants<sup>21,48</sup> and it is therefore misguided to isolate singular actors as the propagators of information distortion such as the authors of the articles in the popular press. Indeed, extensive research has shown how information dissemination through social media creates an abundance of information accuracy challenges.<sup>53,54,55,56</sup>

## Limitations

This study was limited in its ability to capture and analyze all of the microbiome discourse relevant to audiences. Covering the popular press’s portrayal of the microbiome during a period when the topic was popular has provided insights into how microbiome science is being communicated. Future research could replicate this study to see whether, and in what manner, the same trend persists. Additionally, other research projects could explore whether these portrayals are similar or different on popular social media platforms such as Instagram, Twitter, or Tiktok.

Conclusion

Microbiome articles published for North American audiences typically popularize gut health trends while only offering a little in the way of communicating the science. It is promising to see cases where some complexities of the research were presented alongside ongoing applications, but the overall number of articles which did this were few. The ongoing communication of accurate science will require a more concerted effort from all of those involved in the process.

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## Footnotes

### Acknowledgements

The authors thank Carly Giles, Allison Jandura, Charisse Petersen, and Robyn Hyde-Lay for their assistance in the project.

**Contributors:** ARM and TC designed the study with input from SET. ARM collected the data and performed the analysis. ARM and TC interpreted the data. ARM, TC, and SET were involved in drafting and revising the manuscript. All authors approved the final version to be published and agreed to be accountable for all aspects of the work.

**Funding:** The authors would like to thank Genome Canada, Genome Alberta, and the Canadian Institutes for Health Research for their generous support of Childhood asthma and the microbiome – precision health for life: The Canadian Healthy Infant Longitudinal Development (CHILD) study.

**Competing interests** None to declare.

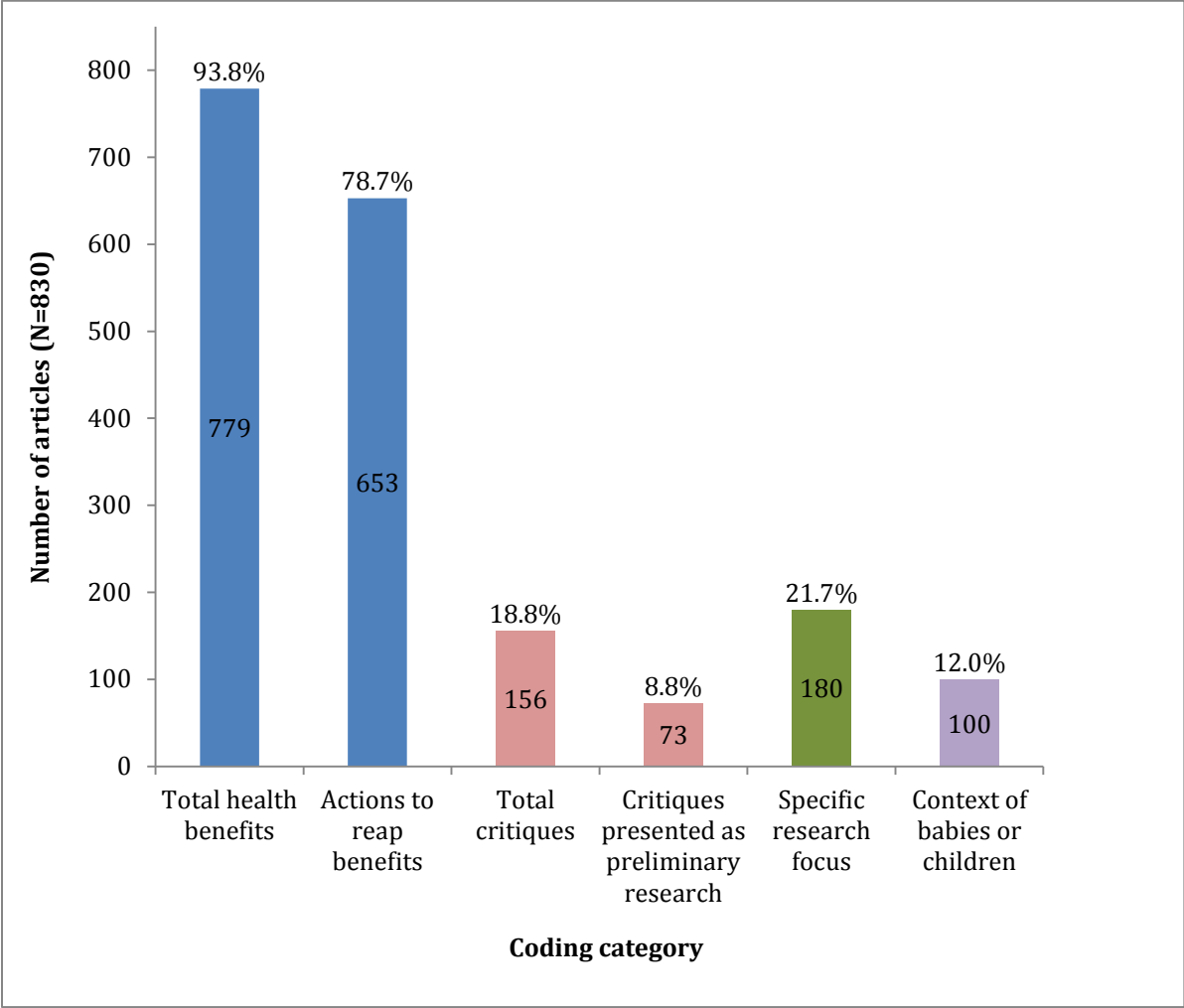
**Patient consent for publication** Not required.

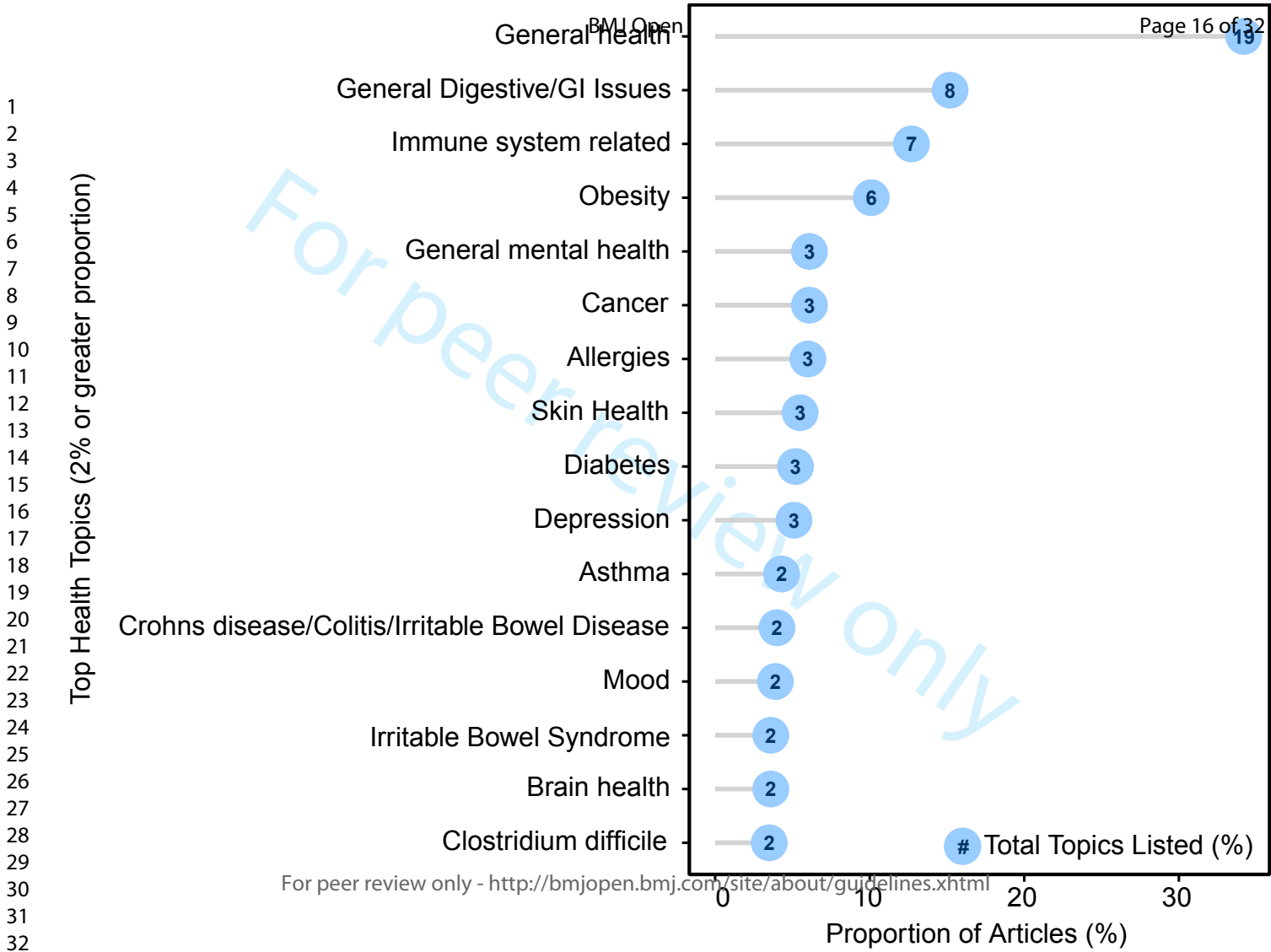
**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available in a public, open access repository. The data set is available: [10.6084/m9.figshare.14410310](https://doi.org/10.6084/m9.figshare.14410310)

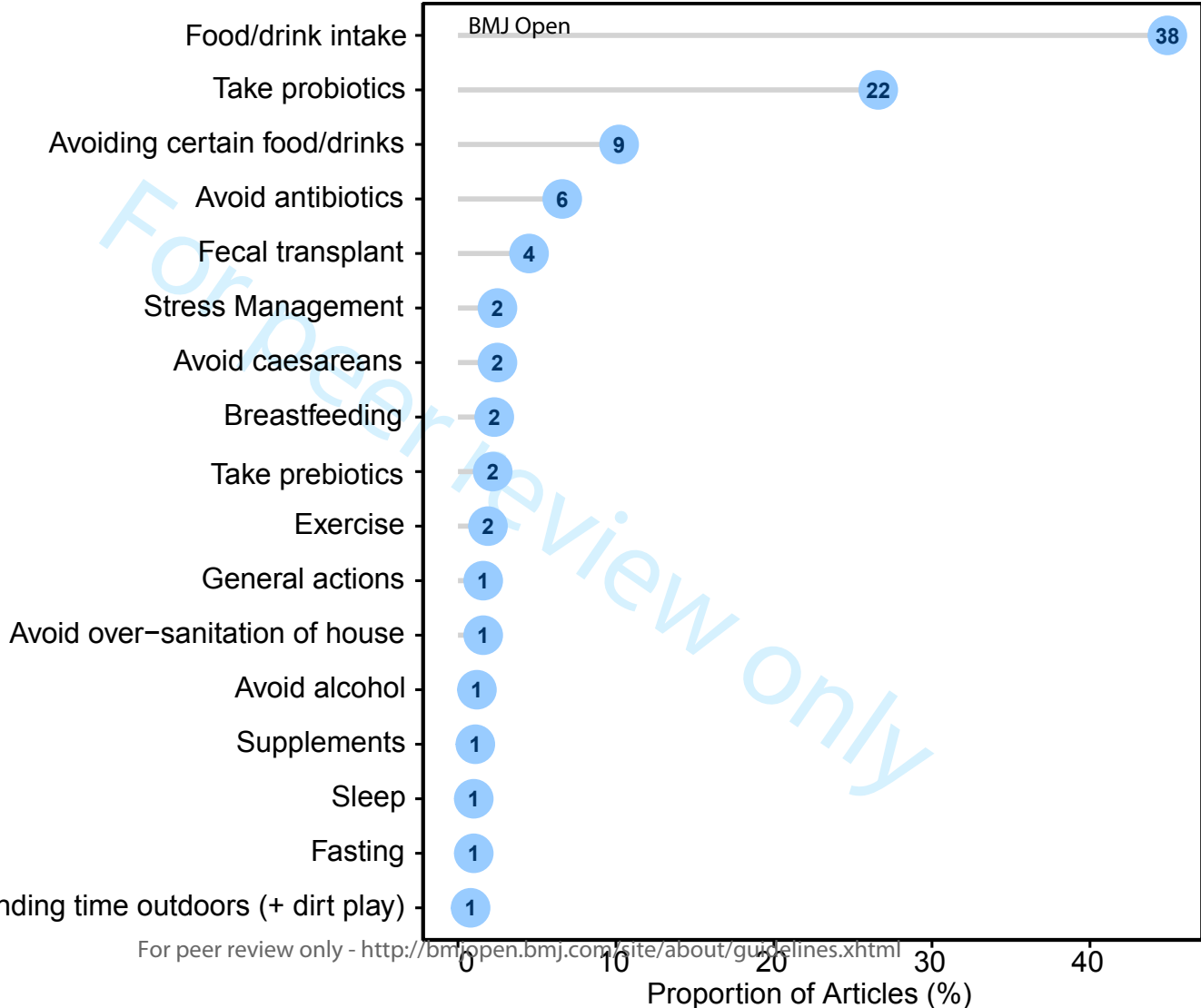
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Figure 1: Microbiome benefits, critiques, research focus and baby/child focus in press articles popular among Canadian and American audiences (N=830)





Top Health Actions for Microbiome Health Benefits



## Supplementary Materials

## FACTIVA search summary

## Search Summary

Text	"gut health" or "healthy gut" or "unhealthy gut" or "gut bacteria" or "microbiota" or "microbiome" or "probiotic" or "probiotics"
Date	01/01/2018 to 10/11/2019
Source	USA Today - All sources Or Los Angeles Times - All sources Or The New York Times - All sources Or Houston Chronicle - All sources Or Chicago Tribune - All sources Or Tampa Bay Times (Fla.) Or Washington Post - All sources Or Newsday (N.Y.) Or New York Post - All sources Or The Dallas Morning News Or The Dallas Morning News Or New York Daily News Or Denver Post - All sources Or The Boston Globe - All sources Or The Seattle Times - All sources Or AM New York Or Star-Tribune (Minneapolis-St. Paul) Or Star-Tribune (Minneapolis-St. Paul) Or The Guardian (U.K.) Or The Telegraph (U.K.) - All sources Or Mirror.co.uk (U.K.) Or Independent Online (U.K.) Or Detroit Free Press - All sources Or The Washington Times Or The Washington Times Or The Oregonian - All sources Or The Times-Picayune Web Edition (New Orleans) Or Orlando Sentinel - All sources Or The Las Vegas Review-Journal Or The Las Vegas Review-Journal Or The Atlanta Journal - Constitution Or Honolulu Star-Advertiser Or Honolulu Star-Advertiser Or The Fort Worth Star-Telegram (Texas) Or Columbus Dispatch - All sources Or The Philadelphia Inquirer Or Worcester Telegram & Gazette (Mass.) Or The Denver Post (Colo.) Or The Buffalo News - All sources Or The San Francisco Chronicle - All sources Or St. Paul Pioneer Press (Minn.) Or The Plain Dealer (Cleveland) Or San Diego Union-Tribune Or The Orange County Register (Calif.) Or The Star-Ledger (Newark, N.J.) Or The Arizona Republic (Phoenix) Or Metro - New York Or MSNBC Network - All sources Or ESPN Or CNN - All sources Or Fox News - All sources Or NPR - Weekend Edition - Sunday Or CBS Network - All sources Or Breitbart News Network Or The Hill (U.S.) Or ABC Network - All sources Or Politico Or Gizmodo Or MarketWatch Or The Daily Beast Or Seeking Alpha Or The Verge Or The Globe and Mail - All sources Or National Post (Canada) Or The Toronto Sun Or The Toronto Star Or Montreal Gazette Or Vancouver Province (British Columbia) Or Vancouver Sun (British Columbia) Or Ottawa Citizen Or The Ottawa Sun (Ontario) Or Calgary Herald (Alberta) Or The Calgary Sun (Alberta) Or Edmonton Journal (Alberta) Or The Edmonton Sun (Alberta) Or Winnipeg Free Press (Manitoba) Or The Winnipeg Sun (Manitoba) Or The Hamilton Spectator (Ontario) Or The London Free Press (Ontario) Or Waterloo Region Record (Ontario) Or Chronicle Herald (Nova Scotia) Or Niagara Falls Review (Ontario) Or Victoria Times Colonist (Vancouver, British Columbia) Or Windsor Star (Ontario) Or Saskatoon Star Phoenix (Saskatchewan) Or Regina Leader Post (Saskatchewan) Or The Telegram (Newfoundland) Or Daily Mail (U.K.) Or The Wall Street Journal Or The Wall Street Journal Online Or Business Insider (U.S.) Or Reuters News Or Reuters Health E-Line
Author	All Authors
Company	All Companies
Subject	All Subjects
Industry	All Industries
Region	All Regions
Language	English
Results Found	2,676
Timestamp	11 October 2019 10:47 AM

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## Gut Health/Microbiome Coding Frame October 2019 / HLI, University of Alberta

## Overview coding for context

1. Choose1: Is the article Relevant or Irrelevant? (Irrelevant articles include: one of the search terms appearing in text with no supporting text or elaboration; transcripts of radio or tv shows; one of the search terms used solely in the context of animal health; duplicate of previously read article)
2. Is the article's main focus highlighting research? Yes/No
3. Does the article include a discussion of babies/children in relation to gut health (including all search terms included)?

## Principle content coding

1. Does the article make claims of health benefits related to gut health (gut bacteria), probiotics, or the microbiome (microbiota)? Yes/No
  - 1b. If yes in #1, what health benefits are listed? [choose all that apply – always code a specific benefit if possible before coding for a more general category]
    - Brain health (memory, learning, cognitive abilities, etc.)
    - General health (no specific items listed but seen as valuable for health, and also, general phrasing such as “optimal gut health”; “optimal health”; “improve wellness”; “manage stress”, “good wellbeing, etc.)
    - General mental health (“mental health”, but no specifics mentioned, etc.)
    - General Digestive/GI Issues (bloating, gas (flatulence), diarrhea, acid reflux, leaky gut also “aiding”, “helping with”, etc.)
    - Skin health (including cosmetic and more serious issues like eczema, psoriasis or other forms of dermatitis)

- Allergies
- Alzheimer’s disease
- Anorexia
- Anxiety
- Arthritis
- Behaviour (children)
- Cancer
- Clostridium difficile (C. diff)
- Colds (“common colds”, etc.)
- Colic
- Crohn’s disease/Colitis/Irritable Bowel Disease
- Dementia
- Depression
- Diabetes
- Energy related (including fatigue, and Chronic Fatigue Syndrome (CFS))
- Fibromyalgia
- Headaches
- Heart related (including heart disease and artery issues)
- Immune system related (“boosting”, improving, fighting off infection, etc.)
- Irritable Bowel Syndrome (IBS)
- Menopause (including hormonal imbalances)
- Mood (improving)
- Multiple Sclerosis
- Obesity (including weight management (weight loss, etc.)
- Oral disease
- Parkinson’s disease
- Pain (including chronic pain, joint pain)
- Pharmaceutical drug development
- Pharmaceutical drug metabolizing
- Pregnancy health (including avoiding premature delivery)
- Other [fill in]

2. Does the article provide information (actions one can take) regarding how an individual can reap benefits related to gut health (gut bacteria), probiotics, or the microbiome (microbiota)? Yes/No

2b) If yes in #2, what actions are mentioned? [list] (e.g. eating certain foods, fecal transplants, etc.)?  
[choose all that apply]

- Food/drink intake (including fostering diversity, and eating schedule/advice related to food timing, chewing, etc.)
- Avoiding certain food/drinks
- Breastfeeding
- Take probiotics
- Take prebiotics
- General actions (“monitor”, “look after”; “take care of”, etc.)
- Avoid antibiotics
- Avoid caesareans (including be wary of; benefits lost if, etc.)
- Avoid over-sanitation of house (including avoiding chemicals in cleaning products)

- Avoid smoking (including stop smoking)
- Exercise
- Fecal transplant (including pills (i.e. “poop pills”))
- Massage
- Sinus microbiome transplant
- Sleep related (get more, get better, etc.)
- Weight management (“control”, etc.)
- Yoga
- Vaginal seeding
- Other [fill in]

3. Does the article state, in any form, that the benefits or current research related to gut health (gut bacteria), probiotics, or the microbiome (microbiota) might be unproven, ineffective or exaggerated? Yes/No

3a) If yes, is this rhetoric described as “(only) preliminary research”, “developing research”, “early stage research”, etc.

4. (ADDITION TO #1, attached to coding platform) Does the article portray probiotics as beneficial without making links to ideas of the microbiome/gut health? Yes/No

#### Complete list of Health Topics

	Health topics	# of articles	(n=732)	n=830	1502
1	General health	284	38.8%	34.2%	18.91%
2	General Digestive/GI Issues	126	17.2%	15.2%	8.39%
3	Immune system related	105	14.3%	12.7%	6.99%
4	Obesity	84	11.5%	10.1%	5.59%
5	Cancer	51	7.0%	6.1%	3.40%
6	General mental health	51	7.0%	6.1%	3.40%
7	Allergies	50	6.8%	6.0%	3.33%
8	Skin Health	46	6.3%	5.5%	3.06%
9	Diabetes	43	5.9%	5.2%	2.86%
10	Depression	42	5.7%	5.1%	2.80%
11	Asthma	36	4.9%	4.3%	2.40%
12	Crohns disease/Colitis/Irritable Bowel Disease	33	4.5%	4.0%	2.20%
13	Mood	32	4.4%	3.9%	2.13%
14	Brain health	30	4.1%	3.6%	2.00%
15	Irritable Bowel Syndrome	30	4.1%	3.6%	2.00%
16	Clostridium difficile	29	4.0%	3.5%	1.93%
17	Inflammation	26	3.6%	3.1%	1.73%

1	18	Anxiety	24	3.3%	2.9%	1.60%
2	19	Inflammatory Bowel Disease	21	2.9%	2.5%	1.40%
3	20	Heart related	18	2.5%	2.2%	1.20%
4	21	Alzheimers disease	15	2.0%	1.8%	1.00%
5	22	Energy related	14	1.9%	1.7%	0.93%
6	23	Parkinsons disease	14	1.9%	1.7%	0.93%
7	24	Autism	12	1.6%	1.4%	0.80%
8	25	Metabolism	11	1.5%	1.3%	0.73%
9	26	Metabolic Disorder	10	1.4%	1.2%	0.67%
10	27	Autoimmune Diseases (disorders)	9	1.2%	1.1%	0.60%
11	28	Diarrhea	9	1.2%	1.1%	0.60%
12	29	Intestinal Permeability (leaky gut)	9	1.2%	1.1%	0.60%
13	30	Sleep	9	1.2%	1.1%	0.60%
14	31	Weight management	9	1.2%	1.1%	0.60%
15	32	Dementia	8	1.1%	1.0%	0.53%
16	33	Menopause	8	1.1%	1.0%	0.53%
17	34	Multiple Sclerosis	7	1.0%	0.8%	0.47%
18	35	Stress	7	1.0%	0.8%	0.47%
19	36	Athletic Performance/Recovery	6	0.8%	0.7%	0.40%
20	37	Liver Disease	6	0.8%	0.7%	0.40%
21	38	Vitamin Absorption	6	0.8%	0.7%	0.40%
22	39	Antibiotic resistance (and recovery)	5	0.7%	0.6%	0.33%
23	40	Arthritis	5	0.7%	0.6%	0.33%
24	41	Metabolic Syndrome	5	0.7%	0.6%	0.33%
25	42	Constipation	4	0.5%	0.5%	0.27%
26	43	Diverticulitis	4	0.5%	0.5%	0.27%
27	44	Eczema in Children	4	0.5%	0.5%	0.27%
28	45	ADHD	3	0.4%	0.4%	0.20%
29	46	Appetite	3	0.4%	0.4%	0.20%
30	47	Bipolar Disorder	3	0.4%	0.4%	0.20%
31	48	cardiovascular disease	3	0.4%	0.4%	0.20%
32	49	Colds	3	0.4%	0.4%	0.20%
33	50	Headaches	3	0.4%	0.4%	0.20%
34	51	Influenza	3	0.4%	0.4%	0.20%
35	52	Lyme Disease	3	0.4%	0.4%	0.20%
36	53	Oral Hygiene	3	0.4%	0.4%	0.20%

54	PKU	3	0.4%	0.4%	0.20%
55	Pregnancy health	3	0.4%	0.4%	0.20%
56	Preventative measures (disease)	3	0.4%	0.4%	0.20%
57	Tooth decay	3	0.4%	0.4%	0.20%
58	Vaginal issues	3	0.4%	0.4%	0.20%
59	Aging	2	0.3%	0.2%	0.13%
60	Behaviour	2	0.3%	0.2%	0.13%
61	Blood circulation	2	0.3%	0.2%	0.13%
62	Bone Health (density)	2	0.3%	0.2%	0.13%
63	Cholesterol	2	0.3%	0.2%	0.13%
64	Eating disorders	2	0.3%	0.2%	0.13%
65	E-coli	2	0.3%	0.2%	0.13%
66	Fibromyalgia	2	0.3%	0.2%	0.13%
67	Gene Activity	2	0.3%	0.2%	0.13%
68	General Beauty and Apperance	2	0.3%	0.2%	0.13%
69	HIV	2	0.3%	0.2%	0.13%
70	Immunity	2	0.3%	0.2%	0.13%
71	Infections (general)	2	0.3%	0.2%	0.13%
72	Jet lag	2	0.3%	0.2%	0.13%
73	Migraine	2	0.3%	0.2%	0.13%
74	Motor Nueron Disease	2	0.3%	0.2%	0.13%
75	Oral disease	2	0.3%	0.2%	0.13%
76	Pain	2	0.3%	0.2%	0.13%
77	Seratonin Levels	2	0.3%	0.2%	0.13%
78	ulcers	2	0.3%	0.2%	0.13%
79	Urea Cycle Disorders	2	0.3%	0.2%	0.13%
80	Urinary Tract Infections	2	0.3%	0.2%	0.13%
81	Polycystic Ovary Syndrome	2	0.3%	0.2%	0.13%
82	Alcohol Cravings	1	0.1%	0.1%	0.07%
83	Anemia	1	0.1%	0.1%	0.07%
84	Antioxidant Status	1	0.1%	0.1%	0.07%
85	Appendicitis	1	0.1%	0.1%	0.07%
86	Appetite	1	0.1%	0.1%	0.07%
87	artery health	1	0.1%	0.1%	0.07%
88	bloodstream infections	1	0.1%	0.1%	0.07%
89	Celiac Disease	1	0.1%	0.1%	0.07%

1	90	Chemotherapy Recovery	1	0.1%	0.1%	0.07%
2	91	Childhood Development	1	0.1%	0.1%	0.07%
3						
4	92	Cholera	1	0.1%	0.1%	0.07%
5	93	Cognitive Disorder	1	0.1%	0.1%	0.07%
6						
7	94	Dental Health/Gingivitis	1	0.1%	0.1%	0.07%
8						
9	95	Emotional Responses	1	0.1%	0.1%	0.07%
10	96	Flu vaccine effectiveness	1	0.1%	0.1%	0.07%
11						
12	97	Gluten Intolerances	1	0.1%	0.1%	0.07%
13						
14	98	Glycemic Control	1	0.1%	0.1%	0.07%
15	99	Gonorrhoea	1	0.1%	0.1%	0.07%
16						
17	100	Gum Disease	1	0.1%	0.1%	0.07%
18	101	H. Pylori Eradication	1	0.1%	0.1%	0.07%
19						
20	102	Hair loss	1	0.1%	0.1%	0.07%
21						
22	103	Hairy tongue	1	0.1%	0.1%	0.07%
23	104	Healing system	1	0.1%	0.1%	0.07%
24						
25	105	Heartburn	1	0.1%	0.1%	0.07%
26						
27	106	Hepatic Encephalopathy	1	0.1%	0.1%	0.07%
28	107	Hormonal Bloating	1	0.1%	0.1%	0.07%
29						
30	108	Hyperammonemia	1	0.1%	0.1%	0.07%
31						
32	109	Hypertension	1	0.1%	0.1%	0.07%
33						
34	110	Improve focus	1	0.1%	0.1%	0.07%
35	111	Infant Breastfeeding	1	0.1%	0.1%	0.07%
36						
37	112	Infertility	1	0.1%	0.1%	0.07%
38	113	Interstitial Cystitis	1	0.1%	0.1%	0.07%
39						
40	114	Iron Deficiency	1	0.1%	0.1%	0.07%
41						
42	115	Kidney Disease	1	0.1%	0.1%	0.07%
43	116	Kidney Stones	1	0.1%	0.1%	0.07%
44						
45	117	Medication Rashes	1	0.1%	0.1%	0.07%
46	118	Melanoma	1	0.1%	0.1%	0.07%
47						
48	119	Menstral health	1	0.1%	0.1%	0.07%
49						
50	120	motor neurone disease	1	0.1%	0.1%	0.07%
51	121	Mucus Colitis	1	0.1%	0.1%	0.07%
52						
53	122	Nervous system related	1	0.1%	0.1%	0.07%
54						
55	123	Osteoarthritis	1	0.1%	0.1%	0.07%
56	124	Osteoporosis	1	0.1%	0.1%	0.07%
57						
58	125	Pharmaceutical drug development	1	0.1%	0.1%	0.07%

126	Pharmaceutical drug metabolizing	1	0.1%	0.1%	0.07%
127	phenylketonuria	1	0.1%	0.1%	0.07%
128	Pneumonia	1	0.1%	0.1%	0.07%
129	Pouchitis	1	0.1%	0.1%	0.07%
130	Premature Births	1	0.1%	0.1%	0.07%
131	psoriasis	1	0.1%	0.1%	0.07%
132	rehab	1	0.1%	0.1%	0.07%
133	Respiratory infections	1	0.1%	0.1%	0.07%
134	Schizophrenia	1	0.1%	0.1%	0.07%
135	Sore Tongue	1	0.1%	0.1%	0.07%
136	Thyroid Condition	1	0.1%	0.1%	0.07%
137	Transplant Success	1	0.1%	0.1%	0.07%
138	UTIs	1	0.1%	0.1%	0.07%

### Complete list of actions

	Health Action	# articles	out of 653 articles with actions	830	983
1	Food/drink intake	373	57.1%	44.9%	37.9%
2	Take probiotics	174	26.6%	21.0%	17.7%
3	Avoiding certain food/drinks	85	13.0%	10.2%	8.6%
4	Avoid antibiotics	55	8.4%	6.6%	5.6%
5	Fecal transplant	37	5.7%	4.5%	3.8%
6	Avoid caesareans	21	3.2%	2.5%	2.1%
7	Stress Management	21	3.2%	2.5%	2.1%
8	Breastfeeding	19	2.9%	2.3%	1.9%
9	Take prebiotics	18	2.8%	2.2%	1.8%
10	Exercise	16	2.5%	1.9%	1.6%
11	Avoid over-sanitation of house	13	2.0%	1.6%	1.3%
12	General actions	13	2.0%	1.6%	1.3%
13	Avoid alcohol	10	1.5%	1.2%	1.0%
14	Supplements	9	1.4%	1.1%	0.9%
15	Fasting	8	1.2%	1.0%	0.8%
16	Sleep	8	1.2%	1.0%	0.8%
17	Spending time outdoors (+ dirt play)	7	1.1%	0.8%	0.7%
18	Medications	5	0.8%	0.6%	0.5%
19	Yoga	4	0.6%	0.5%	0.4%
20	Avoid acid-suppressing drugs	3	0.5%	0.4%	0.3%
21	Colonics	3	0.5%	0.4%	0.3%
22	Detoxes	3	0.5%	0.4%	0.3%
23	Avoid Pollution	2	0.3%	0.2%	0.2%
24	Avoid proton-pump inhibitors	2	0.3%	0.2%	0.2%
25	bacteriophages	2	0.3%	0.2%	0.2%

1	26	Medication Research and Development	2	0.3%	0.2%	0.2%
2	27	Raw water	2	0.3%	0.2%	0.2%
3	28	Use Eco-Friendly Household Cleaners	2	0.3%	0.2%	0.2%
4	29	Mayr Method	2	0.3%	0.2%	0.2%
5	30	Personalized diet	2	0.3%	0.2%	0.2%
6	31	Vaginal Seeding	2	0.3%	0.2%	0.2%
7	32	Monitor poo (and schedule)	2	0.3%	0.2%	0.2%
8	33	Avoid Stomach Acid Blockers	2	0.3%	0.2%	0.2%
9	34	Gut Health Clinics	2	0.3%	0.2%	0.2%
10	35	Eat breakfast	2	0.3%	0.2%	0.2%
11	36	Eat slowly	1	0.2%	0.1%	0.1%
12	37	Hydration	1	0.2%	0.1%	0.1%
13	38	IV/Drip therapy	1	0.2%	0.1%	0.1%
14	39	Vaginal Birth	1	0.2%	0.1%	0.1%
15	40	CBD Oil	1	0.2%	0.1%	0.1%
16	41	Adult Consumption of Breast Milk	1	0.2%	0.1%	0.1%
17	42	Pilates	1	0.2%	0.1%	0.1%
18	43	Liver Treatments	1	0.2%	0.1%	0.1%
19	44	Animal Saliva	1	0.2%	0.1%	0.1%
20	45	Anti-microbials	1	0.2%	0.1%	0.1%
21	46	Appendix Removal	1	0.2%	0.1%	0.1%
22	47	Peppermint Oil	1	0.2%	0.1%	0.1%
23	48	Avoid Childhood Vaccination	1	0.2%	0.1%	0.1%
24	49	Avoid Endocrine Disruptor Exposure	1	0.2%	0.1%	0.1%
25	50	Avoid Giving Infants Scented Baths	1	0.2%	0.1%	0.1%
26	51	Avoid glyphosate fertilizers	1	0.2%	0.1%	0.1%
27	52	Avoid Herbicide Exposure	1	0.2%	0.1%	0.1%
28	53	Avoid intense scrubbing, shaving, waxing and exposure to sun (skin)	1	0.2%	0.1%	0.1%
29	54	Avoid Limiting Transmission of Maternal Microbiota	1	0.2%	0.1%	0.1%
30	55	Avoid Mouthwash	1	0.2%	0.1%	0.1%
31	56	Avoid NSAID painkillers	1	0.2%	0.1%	0.1%
32	57	Avoid smoking	1	0.2%	0.1%	0.1%
33	58	Avoid taking opioids for long periods of time	1	0.2%	0.1%	0.1%
34	59	Hormones	1	0.2%	0.1%	0.1%
35	60	Azithromycin use	1	0.2%	0.1%	0.1%
36	61	Bioengineered Bacteria	1	0.2%	0.1%	0.1%
37	62	City stop spraying glyphosate in city parks	1	0.2%	0.1%	0.1%
38	63	Colon Cancer Screening	1	0.2%	0.1%	0.1%
39	64	Cryotherapy	1	0.2%	0.1%	0.1%
40	65	Drugs Containing Human Gut Microbes	1	0.2%	0.1%	0.1%
41	66	E. Coli Derivative	1	0.2%	0.1%	0.1%
42	67	Electrical Stimulation of the Vagus Nerve	1	0.2%	0.1%	0.1%
43	68	Engineered Genes	1	0.2%	0.1%	0.1%
44	69	Eradicate Gut Health Following Cardiac Arrest	1	0.2%	0.1%	0.1%
45	70	Freeze-Dried Healthy Gut Bacteria	1	0.2%	0.1%	0.1%
46	71	Skin-to-Skin Contact Between Mother and Baby	1	0.2%	0.1%	0.1%
47	72	Gardening	1	0.2%	0.1%	0.1%

73	Gargling and Singing Loudly	1	0.2%	0.1%	0.1%
74	Gratitude Journaling,	1	0.2%	0.1%	0.1%
75	Hormonal Therapy	1	0.2%	0.1%	0.1%
76	Injecting Antibiotics Rather than Ingesting Them	1	0.2%	0.1%	0.1%
77	Interactions with Other Children	1	0.2%	0.1%	0.1%
78	Intestinal Absorbent (Enterogel)	1	0.2%	0.1%	0.1%
79	Lower glycemic load	1	0.2%	0.1%	0.1%
80	microbiome drug	1	0.2%	0.1%	0.1%
81	migration	1	0.2%	0.1%	0.1%
82	more holistic approach to health	1	0.2%	0.1%	0.1%
83	Psychobiotics	1	0.2%	0.1%	0.1%
84	Relationships	1	0.2%	0.1%	0.1%
85	Sinus microbiome transplant	1	0.2%	0.1%	0.1%
86	treatments, diagnostic testing	1	0.2%	0.1%	0.1%
87	Use of probiotic cleaning	1	0.2%	0.1%	0.1%

# Standards for Reporting Qualitative Research: A Synthesis of Recommendations

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## Abstract

### Purpose

Standards for reporting exist for many types of quantitative research, but currently none exist for the broad spectrum of qualitative research. The purpose of the present study was to formulate and define standards for reporting qualitative research while preserving the requisite flexibility to accommodate various paradigms, approaches, and methods.

### Method

The authors identified guidelines, reporting standards, and critical appraisal criteria for qualitative research by searching PubMed, Web of Science, and Google through July 2013; reviewing

the reference lists of retrieved sources; and contacting experts. Specifically, two authors reviewed a sample of sources to generate an initial set of items that were potentially important in reporting qualitative research. Through an iterative process of reviewing sources, modifying the set of items, and coding all sources for items, the authors prepared a near-final list of items and descriptions and sent this list to five external reviewers for feedback. The final items and descriptions included in the reporting standards reflect this feedback.

### Results

The Standards for Reporting Qualitative Research (SRQR) consists of 21

items. The authors define and explain key elements of each item and provide examples from recently published articles to illustrate ways in which the standards can be met.

### Conclusions

The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research. These standards will assist authors during manuscript preparation, editors and reviewers in evaluating a manuscript for potential publication, and readers when critically appraising, applying, and synthesizing study findings.

Qualitative research contributes to the literature in many disciplines by describing, interpreting, and generating theories about social interactions and individual experiences as they occur in natural, rather than experimental, situations.<sup>1–3</sup> Some recent examples include studies of professional dilemmas,<sup>4</sup> medical students' early experiences of workplace learning,<sup>5</sup> patients' experiences of disease and interventions,<sup>6–8</sup> and patients' perspectives about incident disclosures.<sup>9</sup> The purpose of qualitative research is to understand the perspectives/experiences of individuals or groups and the contexts in which these perspectives or experiences are situated.<sup>1,2,10</sup>

Qualitative research is increasingly common and valued in the medical and medical education literature.<sup>1,10–13</sup> However, the quality of such research can be difficult to evaluate because of incomplete reporting of key elements.<sup>14,15</sup> Quality is multifaceted and includes consideration of the importance of the research question, the rigor of the research methods, the appropriateness and salience of the inferences, and the clarity and completeness of reporting.<sup>16,17</sup> Although there is much debate about standards for methodological rigor in qualitative research,<sup>13,14,18–20</sup> there is widespread agreement about the need for clear and complete reporting.<sup>14,21,22</sup> Optimal reporting would enable editors, reviewers, other researchers, and practitioners to critically appraise qualitative studies and apply and synthesize the results. One important step in improving the quality of reporting is to formulate and define clear reporting standards.

nearly all cases, the authors do not describe how the guidelines were created, and often fail to distinguish reporting quality from the other facets of quality (e.g., the research question or methods). Several authors suggest standards for reporting qualitative research,<sup>15,20,29–33</sup> but their articles focus on a subset of qualitative data collection methods (e.g., interviews), fail to explain how the authors developed the reporting criteria, narrowly construe qualitative research (e.g., thematic analysis) in ways that may exclude other approaches, and/or lack specific examples to help others see how the standards might be achieved. Thus, there remains a compelling need for defensible and broadly applicable standards for reporting qualitative research.

We designed and carried out the present study to formulate and define standards for reporting qualitative research through a rigorous synthesis of published articles and expert recommendations.

### Method

We formulated standards for reporting qualitative research by using a rigorous and systematic approach in which we reviewed previously proposed

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Acad Med. 2014;89:1245–1251.  
First published online June 20, 2014  
doi: 10.1097/ACM.0000000000000388

Supplemental digital content for this article is available at <http://links.lww.com/ACADMED/A218>.

Authors have proposed guidelines for the quality of qualitative research, including those in the fields of medical education,<sup>23–25</sup> clinical and health services research,<sup>26–28</sup> and general education research.<sup>29,30</sup> Yet in

recommendations by experts in qualitative methods. Our research team consisted of two PhD researchers and one physician with formal training and experience in qualitative methods, and two physicians with experience, but no formal training, in qualitative methods.

We first identified previously proposed recommendations by searching PubMed, Web of Science, and Google using combinations of terms such as “qualitative methods,” “qualitative research,” “qualitative guidelines,” “qualitative standards,” and “critical appraisal” and by reviewing the reference lists of retrieved sources, reviewing the Equator Network,<sup>22</sup> and contacting experts. We conducted our first search in January 2007 and our last search in July 2013. Most recommendations were published in peer-reviewed journals, but some were available only on the Internet, and one was an interim draft from a national organization. We report the full set of the 40 sources reviewed in Supplemental Digital Appendix 1, found at <http://links.lww.com/ACADMED/A218>.

Two of us (B.O., I.H.) reviewed an initial sample of sources to generate a comprehensive list of items that were potentially important in reporting qualitative research (Draft A). All of us then worked in pairs to review all sources and code the presence or absence of each item in a given source. From Draft A, we then distilled a shorter list (Draft B) by identifying core concepts and combining related items, taking into account the number of times each item appeared in these sources. We then compared the items in Draft B with material in the original sources to check for missing concepts, modify accordingly, and add explanatory definitions to create a prefinal list of items (Draft C).

We circulated Draft C to five experienced qualitative researchers (see the acknowledgments) for review. We asked them to note any omitted or redundant items and to suggest improvements to the wording to enhance clarity and relevance across a broad spectrum of qualitative inquiry. In response to their reviews, we consolidated some items and made minor revisions to the wording of labels and definitions to create the final set of reporting standards—the Standards for Reporting

Qualitative Research (SRQR)—summarized in Table 1.

To explicate how the final set of standards reflect the material in the original sources, two of us (B.O., D.A.C.) selected by consensus the 25 most complete sources of recommendations and identified which standards reflected the concepts found in each original source (see Table 2).

## Results

The SRQR is a list of 21 items that we consider essential for complete, transparent reporting of qualitative research (see Table 1). As explained above, we developed these items through a rigorous synthesis of prior recommendations and concepts from published sources (see Table 2; see also Supplemental Digital Appendix 1, found at <http://links.lww.com/ACADMED/A218>) and expert review. These 21 items provide a framework and recommendations for reporting qualitative studies. Given the wide range of qualitative approaches and methodologies, we attempted to select items with broad relevance.

The SRQR includes the article’s title and abstract (items 1 and 2); problem formulation and research question (items 3 and 4); research design and methods of data collection and analysis (items 5 through 15); results, interpretation, discussion, and integration (items 16 through 19); and other information (items 20 and 21). Supplemental Digital Appendix 2, found at <http://links.lww.com/ACADMED/A218>, contains a detailed explanation of each item, along with examples from recently published qualitative studies. Below, we briefly describe the standards, with a particular focus on those unique to qualitative research.

### Titles, abstracts, and introductory

**material.** Reporting standards for titles, abstracts, and introductory material (problem formulation, research question) in qualitative research are very similar to those for quantitative research, except that the results reported in the abstract are narrative rather than numerical, and authors rarely present a specific hypothesis.<sup>29,30</sup>

**Research design and methods.** Reporting on research design and methods of data collection and analysis highlights several distinctive features of qualitative research. Many of the criteria we reviewed focus not only on identifying and describing all aspects of the methods (e.g., approach, researcher characteristics and role, sampling strategy, context, data collection and analysis) but also on justifying each choice.<sup>13,14</sup> This ensures that authors make their assumptions and decisions transparent to readers. This standard is less commonly expected in quantitative research, perhaps because most quantitative researchers share positivist assumptions and generally agree about standards for rigor of various study designs and sampling techniques.<sup>14</sup> Just as quantitative reporting standards encourage authors to describe how they implemented methods such as randomization and measurement validity, several qualitative reporting criteria recommend that authors describe how they implemented a presumably familiar technique in their study rather than simply mentioning the technique.<sup>10,14,32</sup> For example, authors often state that data collection occurred until saturation, with no mention of how they defined and recognized saturation. Similarly, authors often mention an “iterative process,” with minimal description of the nature of the iterations. The SRQR emphasizes the importance of explaining and elaborating on these important processes. Nearly all of the original sources recommended describing the characteristics and role of the researcher (i.e., reflexivity). Members of the research team often form relationships with participants, and analytic processes are highly interpretive in most qualitative research. Therefore, reviewers and readers must understand how these relationships and the researchers’ perspectives and assumptions influenced data collection and interpretation.<sup>15,23,26,34</sup>

**Results.** Reporting of qualitative research results should identify the main analytic findings. Often, these findings involve interpretation and contextualization, which represent a departure from the tradition in quantitative studies of objectively reporting results. The presentation of results often varies with the specific qualitative approach and methodology; thus, rigid rules for reporting qualitative findings are inappropriate. However, authors

Table 1  
Standards for Reporting Qualitative Research (SRQR)<sup>a</sup>

No.	Topic	Item
<b>Title and abstract</b>		
S1	Title	✓ Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended
S2	Abstract	✓ Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions
<b>Introduction</b>		
S3	Problem formulation	✓ Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement
S4	Purpose or research question	✓ Purpose of the study and specific objectives or questions
<b>Methods</b>		
S5	Qualitative approach and research paradigm	✓ Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/interpretivist) is also recommended; rationale <sup>b</sup>
S6	Researcher characteristics and reflexivity	✓ Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability
S7	Context	✓ Setting/site and salient contextual factors; rationale <sup>b</sup>
S8	Sampling strategy	✓ How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale <sup>b</sup>
S9	Ethical issues pertaining to human subjects	✓ Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues
S10	Data collection methods	✓ Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale <sup>b</sup>
S11	Data collection instruments and technologies	✓ Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study
S12	Units of study	✓ Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)
S13	Data processing	✓ Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/deidentification of excerpts
S14	Data analysis	✓ Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale <sup>b</sup>
S15	Techniques to enhance trustworthiness	✓ Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale <sup>b</sup>
<b>Results/ findings</b>		
S16	Synthesis and interpretation	✓ Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory
S17	Links to empirical data	✓ Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings
<b>Discussion</b>		
S18	Integration with prior work, implications, transferability, and contribution(s) to the field	✓ Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field
S19	Limitations	✓ Trustworthiness and limitations of findings

(Table continues)

Table 1  
(Continued)

No.	Topic	Item
<b>Other</b>		
S20	Conflicts of interest	✓ Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed
S21	Funding	✓ Sources of funding and other support; role of funders in data collection, interpretation, and reporting

<sup>a</sup>The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

<sup>b</sup>The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

should provide evidence (e.g., examples, quotes, or text excerpts) to substantiate the main analytic findings.<sup>20,29</sup>

**Discussion.** The discussion of qualitative results will generally include connections to existing literature and/or theoretical or conceptual frameworks, the scope and boundaries of the results (transferability), and study limitations.<sup>10–12,28</sup> In some qualitative traditions, the results and discussion may not have distinct boundaries; we recommend that authors include the substance of each item regardless of the section in which it appears.

## Discussion

The purpose of the SRQR is to improve the quality of reporting of qualitative research studies. We hope that these 21 recommended reporting standards will assist authors during manuscript preparation, editors and reviewers in evaluating a manuscript for potential publication, and readers when critically appraising, applying, and synthesizing study findings. As with other reporting guidelines,<sup>35–37</sup> we anticipate that the SRQR will evolve as it is applied and evaluated in practice. We welcome suggestions for refinement.

Qualitative studies explore “how?” and “why?” questions related to social or human problems or phenomena.<sup>10,38</sup> Purposes of qualitative studies include understanding meaning from participants’ perspectives (How do they interpret or make sense of an event, situation, or action?); understanding the nature and

influence of the context surrounding events or actions; generating theories about new or poorly understood events, situations, or actions; and understanding the processes that led to a desired (or undesired) outcome.<sup>38</sup> Many different approaches (e.g., ethnography, phenomenology, discourse analysis, case study, grounded theory) and methodologies (e.g., interviews, focus groups, observation, analysis of documents) may be used in qualitative research, each with its own assumptions and traditions.<sup>1,2</sup> A strength of many qualitative approaches and methodologies is the opportunity for flexibility and adaptability throughout the data collection and analysis process. We endeavored to maintain that flexibility by intentionally defining items to avoid favoring one approach or method over others. As such, we trust that the SRQR will support all approaches and methods of qualitative research by making reports more explicit and transparent, while still allowing investigators the flexibility to use the study design and reporting format most appropriate to their study. It may be helpful, in the future, to develop approach-specific extensions of the SRQR, as has been done for guidelines in quantitative research (e.g., the CONSORT extensions).<sup>37</sup>

## Limitations, strengths, and boundaries

We deliberately avoided recommendations that define methodological rigor, and therefore it would be inappropriate to use the SRQR to judge the quality of research methods and findings. Many of the original sources from which we derived the SRQR were intended as

criteria for methodological rigor or critical appraisal rather than reporting; for these, we inferred the information that would be needed to evaluate the criterion. Occasionally, we found conflicting recommendations in the literature (e.g., recommending specific techniques such as multiple coders or member checking to demonstrate trustworthiness); we resolved these conflicting recommendations through selection of the most frequent recommendations and by consensus among ourselves.

Some qualitative researchers have described the limitations of checklists as a means to improve methodological rigor.<sup>13</sup> We nonetheless believe that a checklist for reporting standards will help to enhance the transparency of qualitative research studies and thereby advance the field.<sup>29,39</sup>

Strengths of this work include the grounding in previously published criteria, the diversity of experience and perspectives among us, and critical review by experts in three countries.

## Implications and application

Similar to other reporting guidelines,<sup>35–37</sup> the SRQR may be viewed as a starting point for defining reporting standards in qualitative research. Although our personal experience lies in health professions education, the SRQR is based on sources originating in diverse health care and non-health-care fields. We intentionally crafted the SRQR to include various paradigms, approaches, and methodologies used in qualitative research. The elaborations offered in

Table 2  
Alignment of the 21 Standards for Reporting Qualitative Research (SRQR) With  
Recommendations From 25 Original Sources<sup>a</sup>

No.	Topic	Reference no. <sup>b</sup>																									
		11,12	15 <sup>c</sup>	19	20 <sup>c</sup>	23	24,25 <sup>d</sup>	26	27	29 <sup>c,d</sup>	30 <sup>c,d</sup>	31 <sup>c</sup>	32 <sup>c</sup>	33	34	41	42	43	44 <sup>c</sup>	45	46	47	48	49	50		
S1	Title						*	*		*															*		
S2	Abstract						*			*	*			*													
S3	Problem formulation				*	*	*	*	*	*	*			*	*	*	*	*			*			*	*		
S4	Purpose or research question	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*		
S5	Qualitative approach and research paradigm	*	*	*	*	*	*	*		*	*		*	*		*	*	*			*	*	*	*	*		
S6	Researcher characteristics, reflexivity	*	*	*	*	*	*	*	*	*		*	*	*		*	*	*	*	*	*	*	*	*	*		
S7	Context		*	*	*	*	*	*	*	*	*	*		*		*	*		*	*	*		*	*			
S8	Sampling strategy	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*			
S9	Ethical issues pertaining to human subjects	*			*		*			*	*		*	*		*	*	*		*	*	*		*			
S10	Data collection methods	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
S11	Data collection instruments/ technologies	*	*				*			*	*	*	*	*		*		*		*		*		*			
S12	Units of study	*	*		*		*	*		*	*	*	*	*		*				*		*		*			
S13	Data processing	*				*	*	*		*	*	*	*				*			*		*		*			
S14	Data analysis	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
S15	Techniques to enhance trustworthiness	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
S16	Synthesis and interpretation	*	*		*	*	*	*	*	*	*	*	*	*		*	*	*			*	*	*	*	*		
S17	Links to empirical data	*	*		*	*	*	*	*	*	*	*		*		*	*	*	*			*	*	*	*		
S18	Integration with prior work, implications, transferability, and contribution(s)	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*		
S19	Limitations	*			*	*	*	*		*				*		*	*	*			*			*	*		
S20	Conflicts of interest						*			*																	
S21	Funding									*					*									*	*		

<sup>a</sup>The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research. In the table, the asterisks indicate which sources mentioned which topics.

<sup>b</sup>The numbers in column headings are the numbers of the citations in the reference list at the end of this report. Those citations are of original sources describing criteria for reporting and/or critical appraisal of qualitative research, which the authors used in creating the SRQR.

<sup>c</sup>Focuses on reporting standards (all other sources focus on quality standards or guidelines for critical review/evaluation).

<sup>d</sup>Addresses quantitative and qualitative research.

Supplemental Digital Appendix 2 (see <http://links.lww.com/ACADMED/A218>) should provide sufficient

description and examples to enable both novice and experienced researchers to use these standards. Thus, the

SRQR should apply broadly across disciplines, methodologies, topics, study participants, and users.

The SRQR items reflect information essential for inclusion in a qualitative research report, but should not be viewed as prescribing a rigid format or standardized content. Individual study needs, author preferences, and journal requirements may necessitate a different sequence or organization than that shown in Table 1. Journal word restrictions may prevent a full exposition of each item, and the relative importance of a given item will vary by study. Thus, although all 21 standards would ideally be reflected in any given report, authors should prioritize attention to those items that are most relevant to the given study, findings, context, and readership.

Application of the SRQR need not be limited to the writing phase of a given study. These standards can assist researchers in planning qualitative studies and in the careful documentation of processes and decisions made throughout the study. By considering these recommendations early on, researchers may be more likely to identify the paradigm and approach most appropriate to their research, consider and use strategies for ensuring trustworthiness, and keep track of procedures and decisions.

Journal editors can facilitate the review process by providing the SRQR to reviewers and applying its standards, thus establishing more explicit expectations for qualitative studies. Although the recommendations do not address or advocate specific approaches, methods, or quality standards, they do help reviewers identify information that is missing from manuscripts.

As authors and editors apply the SRQR, readers will have more complete information about a given study, thus facilitating judgments about the trustworthiness, relevance, and transferability of findings to their own context and/or to related literature. Complete reporting will also facilitate meaningful synthesis of qualitative results across studies.<sup>40</sup> We anticipate that such transparency will, over time, help to identify previously unappreciated gaps in the rigor and relevance of research findings. Investigators, editors, and educators can then work to remedy these deficiencies and, thereby, enhance the overall quality of qualitative research.

*Acknowledgments:* The authors thank Margaret Bearman, PhD, Calvin Chou, MD, PhD, Karen

Hauer, MD, Ayelet Kuper, MD, DPhil, Arianne Teherani, PhD, and participants in the UCSF weekly educational scholarship works-in-progress group (ESCape) for critically reviewing the Standards for Reporting Qualitative Research.

*Funding/Support:* This study was funded in part by a research review grant from the Society for Directors of Research in Medical Education.

*Other disclosures:* None reported.

*Ethical approval:* Reported as not applicable.

*Disclaimer:* The funding agency had no role in the study design, analysis, interpretation, writing of the manuscript, or decision to submit the manuscript for publication.

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# BMJ Open

## "Gut health" and the microbiome in the popular press: A content analysis

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-052446.R1
Article Type:	Original research
Date Submitted by the Author:	29-Jun-2021
Complete List of Authors:	Marcon, Alessandro; University of Alberta, Health Law Institute; Turvey, Stuart; British Columbia Children's Hospital Caulfield, Timothy; University of Alberta, Faculty of Law
<b>Primary Subject Heading</b>:	Genetics and genomics
Secondary Subject Heading:	Communication, Public health, Qualitative research, Nutrition and metabolism
Keywords:	MICROBIOLOGY, PUBLIC HEALTH, QUALITATIVE RESEARCH

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## Title Page

**Article Title: "Gut health" and the microbiome in the popular press: A content analysis**

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**Word Count: 3498**

**Abstract**

**Objective**

Extensive research and important discoveries on the microbiome has led to a growth in media coverage. This study explores how the microbiome has been portrayed in press sources popular among American and Canadian audiences.

**Design**

Content analysis.

**Methods**

Using the FACTIVA database, we compiled a finalized dataset of (N=830) articles from press sources popular among American and Canadian audiences which were published between January 1, 2018- October 11th, 2019 and which contained at least one of the following search terms: “microbiome”, “microbiota”, “gut health”, “healthy gut”, “unhealthy gut”, “gut bacteria”, “probiotic” or “probiotics.” We performed content analysis on the articles to determine how often ideas of the microbiome were presented as beneficial, in which health contexts, and whether actions could be taken to reap stated benefits. We compared this portrayal of benefits with critical portrayals of the microbiome.

**Results**

Almost all of the articles (94%) described health benefits associated with the microbiome with many (79%) describing actions which could be taken to reap stated benefits. Articles most often described health benefits in more broad, general context (34%) and most commonly outlined actions related to food/drug (45%) as well as probiotic (27%) intake. Only some articles (19%) provided microbiome-related critiques or limitations. Some of the articles (22%) were focused on highlighting specific research developments, and in these articles, critiques or limitations were more common.

**Conclusions**

Articles discussing the microbiome published for American and Canadian audiences typically hype the microbiome’s impact and popularize gut health trends while only offering a little in the way of communicating microbiome science. Lifestyle choices including nutrition, taking probiotics, stress management, and exercise are often promoted as means of reaping the microbiome-related health benefits. The trend of actionable “gut health” is foregrounded over more evidence-based descriptions of microbiome science.

## Strengths and limitations of this study

- The study included a large data set of microbiome-related articles from media sources popular among Canadian and American audiences.
- Analysis was able to provide a detailed examination of how ideas around the microbiome are being portrayed for audiences
- The data set represented only one kind of media output (articles in the popular press)
- The data set represented only English-language media

## Introduction

The term microbiome (derived from the Greek for ‘small life’) encompasses the microbial community that lives in and on our bodies, as well as the genes these microorganisms express and their metabolic activity. Over the past decade technological advances in genetic sequencing have greatly accelerated our understanding of the human microbiome in health and disease. Fueled by extensive research, important discoveries about the microbiome have steadily increased resulting in a growth in coverage by the popular media.<sup>1,2,3,4,5,6</sup> Researchers have been examining the roles that diverse microorganisms play in shaping our environments and impacting our health.<sup>7,8</sup> This includes exploration of how the microbiome may influence, for example, risk of obesity,<sup>9</sup> cancer<sup>10</sup> mental health outcomes,<sup>11,12</sup> and cardiometabolic and chronic disorders.<sup>13</sup> Other research has been investigating the microbiome’s role in childhood asthma<sup>14,15,16</sup> as well as the how the use of antibiotics alter gut microbiota.<sup>16,17,18</sup> Currently, however, there are only a few microbiome-related interventions in use,<sup>19,20</sup> and critiques have been made around the hyping<sup>21</sup> of gut microbiome’s potential impact in various contexts.<sup>1,4,22,23,24,25,26,27</sup> In particular, while research has indicated benefits for the use of probiotics in the context of paediatric antibiotic-associated diarrhoea,<sup>28</sup> critiques have also been raised about the exaggerated benefits attributed to probiotics.<sup>29,30,31</sup>

Concerns have also been raised around the popularization and commercialization of microbiome-related research, particularly with regards to its portrayal in the popular press and on social media.<sup>3,4,6,12,22,32</sup> Searches on Google, for example, yield an extensive assortment of microbiome-related discourse detailing products, therapies, and research developments, including gut makeovers, gut health diets, cleanses, microbiome reboots, probiotic products, skin regimens, cures for disease, and treatments such as colonic hydrotherapy or colonic refluorastation. It was also observed during the COVID-19 pandemic that ideas of gut health circulated often when immune-boosting was discussed.<sup>33</sup> In the case of faecal transplants, for example, while clinical research is progressing and showing signs of promise,<sup>34</sup> there has already been a case of a Canadian naturopath using the procedure to treat children with autism.<sup>35</sup> Research has shown that in the context of microbiota-gut-brain (MGB) axis, articles in popular press simplify research and potential health impacts by highlighting “dietary change (including probiotics) as a ‘natural’ means of changing the microbiome, and thus host health status.”<sup>4</sup> Further media research has indicated that microbiome coverage tends to focus on observational studies with less coverage given to

clinical trials and systematic reviews.<sup>32</sup> Indeed, as noted by Reid, Gadir and Dhir<sup>29</sup> “on a consistent basis scientists, media and industry misrepresent probiotics or make generalized statements that illustrate a misunderstanding of their utility and limitations.”

This project analyzed portrayals of the microbiome in popular English-language news sources for American and Canadian audiences. We mapped out how often, and for which health topics and conditions, microbiome ideas were portrayed as beneficial. We then determined how often, and which actions were presented in order to obtain stated benefits. Lastly, we examined how often ideas of the microbiome were presented critically – that is, whether microbiome benefits or actions were presented as unproven, uncertain, ineffective, or exaggerated.

**Methods**

To examine how the microbiome was portrayed in the popular press, we performed directed content analysis<sup>36</sup> on a rigorously selected sample of articles published in newspaper sources popular among English-speaking American and Canadian audiences.<sup>37</sup> We used the FACTIVA database to search for and download all articles published on a popular source list between January 1, 2018 and October 11, 2019 (the day of data collection), which contained at least one of the following search terms: “microbiome”, “microbiota”, “gut health”, “healthy gut”, “unhealthy gut”, “gut bacteria”, “probiotic” or “probiotics.” The search terms were chosen to capture microbiome-related media content created for general audiences without excluding the presence of more specific, research-focused content. The terms were finalized after various reviews of sample searches were performed. The timeframe was selected as it was observed through FACTIVA searches and analysis on google trends that the topics of “microbiome” and “gut health” had been steadily and increasingly receiving media attention from 2010 onwards with no apparent deviations. See Supplementary Materials for search summary and list of sources including article counts.

After the removal of duplicates by FACTIVA, our initial dataset totaled 1395 articles, which were downloaded into and made accessible for analysis through the creation of customized platform. We then developed a coding frame using the inductive and deductive methods established by our team from previous studies,<sup>38,39</sup> which involved creating an initial coding frame, applying it to a large sample of the data, and modifying it as necessary to accurately capture the reality of the content. The coding frame had three primary objectives: 1) to determine if claims of health benefits were made in relation to the microbiome (including ideas captured with associated rhetoric, “gut health”, “gut bacteria”, “probiotics”, “microbiota”, etc.), and if so, which health topics these benefits were described in relation to (i.e. allergies, cancer, skin health, general health (“wellness”), etc.); 2) to determine if the article described actions that could be taken to reap the claimed benefits, and if so, what these actions were (i.e. eat certain foods, take probiotics, perform fecal transplants, etc.); and 3) to determine if any benefits or research related to the microbiome might be portrayed as unproven, uncertain, ineffective or exaggerated. Through the sample analysis, specific categories to classify health benefits and related actions were developed, and three further coding categories were established: 1) whether the article’s principal focus was on scientific research, either pertaining to a particular project or summarizing a body of work; 2) whether the article discussed babies or children in relation to the microbiome; and 3) whether an article portrayed taking

probiotics as beneficial without describing or connecting that probiotic intake to health benefits associated with the microbiome. See Supplementary Materials for complete coding frame.

During coding, articles that were coded as irrelevant were removed, and the finalized total data set resulted in (N=830) articles. Articles were deemed irrelevant if they were duplicates, incomplete (e.g. a “gut health” headline embedded in an unrelated article), television show transcripts, or focused exclusively on animal biology or business developments. All articles were coded by two coders who met periodically to discuss any irregularities and reach consensus on disagreements. This process, as outlined and enacted in other research projects,<sup>36,40,41</sup> entailed coders being instructed to flag any articles which posed coding ambiguities, and on each meeting collaboratively coding these uncertainties through discussion and consensus. Once all articles had been coded, each coder performed an audit on a sample of articles coded by the other coder to ensure no significant issues were present.

### Patient and public involvement

This research was done without patient or public involvement. Patients or members of the public were not invited to comment on the study design and were not consulted to interpret the results. Patients or members of the public were not invited to contribute to the writing or editing of this document for readability or accuracy. Funders had no input on the decision to publish nor the content.

## Results

The 830 articles were published in a total of 41 sources of which 143 (17.2%) came from 18 Canadian sources, 244 (29.4%) came from 18 American sources, and 443 (53.4%) came from the 5 sources based in the UK. Of the 830 articles, 439 (52.9%) were published in 2018, and 391 (47.1%) were published in 2019 (before October 11th). In describing the findings, we will use the term “microbiome” as an all-encompassing term for all associated rhetoric.

It was considerably more common for articles to discuss the microbiome in a non-research specific context (n=650, 78.3%) than to focus on specific research (n=180, 21.7%) (Figure 1). In total, 779 articles (93.8%) discussed health benefits in relation to the microbiome. The vast majority (n= 732, 88.2%) did so including (detailed) descriptions of gut health, the microbiome, gut bacteria, etc. while some articles (n=47, 5.7%) did so simply portraying probiotics as beneficial without mentioning “gut health” or the “microbiome.” Articles of this nature, for example, described probiotic-based health regimes of athletes, bars and restaurants offering probiotic health drinks, spas providing probiotic shots, and raw water products containing beneficial probiotics.

Actions one could take to reap the health benefits associated with the microbiome appeared in n=653, 78.7% of all articles, and 89.2% of all articles that discussed microbiome benefits (Figure 1). Some articles discussed the microbiome in the context of babies or children (n=100, 12%), with approximately half of these 100 articles (n=46) focused on specific research developments. Articles discussing the microbiome in the context of babies or children made up a quarter (25.6%) of all research-focused articles. A total of 156 articles (18.8%) provided critiques, suggesting that either

generally or in specific contexts, the health benefits and/or current research of the microbiome might be unproven, uncertain, ineffective, or exaggerated (Figure 1).

In total there were more than 135 different health topics for which the microbiome was portrayed as beneficial (See Supplementary Materials for complete list). The health topics most commonly associated with the microbiome are presented in Table 1 and Figure 2. Some topics appearing in fewer than 4.0% of articles included anxiety (n=24, 3.3%), Alzheimer’s disease (n=15, 2.0%), Parkinson’s disease (n=14, 1.9%), autism (n=12, 1.6%), dementia (n=8, 1.1%), and menopause (n=8, 1.1%). The majority of the articles discussed the microbiome in relation to one health topic (n=455, 62.2%), while 86 (11.8%) connected the microbiome with four or more health topics in the same article. Some singular articles, for example, discussed the microbiome in relation to a wide range of health topics such as allergies, diabetes, obesity, Parkinson’s disease, asthma, autism, Alzheimer’s disease, etc.

The health topic of “general health” was categorized in cases where an article would state, for example, that certain foods were “more beneficial for our gut health than other sources,” that certain foods “maintain a health balance of gut bacteria,” that a particular vitamin product “boosts gut health,” or that helpful health plans could be “built on a person’s gut microbiome.” In cases such as these, there was typically no further reference to what, or how, the microbiome assists, with the articles instead simply stating that “gut health” or the “microbiome” was something valuable and beneficial to one’s health and should therefore be “maintained,” “balanced,” “strengthened,” etc.

Table 1: Health topics where microbiome benefits were portrayed (min 4.0% of articles with health benefits)

Health topics	# of articles	% of total health topics listed (n=1502)	% of total articles (n=830)
General health	284	18.9	34.2
General Digestive/GI Issues	126	8.4	15.2
Immune system related	105	7.0	12.7
Obesity	84	5.6	10.1
Cancer	51	3.4	6.1
General mental health	51	3.4	6.1
Allergies	50	3.3	6.0
Skin Health	46	3.1	5.5
Diabetes	43	2.9	5.2
Depression	42	2.8	5.1
Asthma	36	2.4	4.3
Crohn's/Colitis/Inflam. Bowel Disease	33	2.2	4.0
Mood	32	2.1	3.9
Brain health	30	2.0	3.6
Irritable Bowel Syndrome	30	2.0	3.6
Clostridium difficile	29	1.9	3.5

Of articles describing these microbiome-related health benefits (n=732), the vast majority described actions which could be taken to reap said benefits (n=653, 89.2%). In total there more than 85 unique actions listed in the articles (See Supplementary Materials for complete list). The five most common actions included food/drink intake (n=373, 44.9%), taking probiotics (n=174, 21.0%), avoiding certain foods/drink (n=85, 10.2%) and avoiding antibiotics (n=55, 6.6%). The most common actions are presented in Table 2 and Figure 3. Incorporating the additional articles which detailed the beneficial qualities of probiotics without making an explicit link to gut health or the microbiome resulted in a total of 221 (26.6%) articles portraying probiotics intake as beneficial (Figure 3). It was not the goal to identify all of the specific foods and drinks listed to improve gut health, but some commonly listed foods included fermented foods such as kombucha, yogurt, kefir, kimchi, etc. as well as lentils, fresh fruit, and vegetables.

The actions of “avoidance” were illustrated both implicitly and explicitly, with implicit cases typically detailing the potentially harmful effects of certain actions. For example, with food avoidance, links were made between artificial sweeteners and unhealthy gut bacteria and their associations with obesity and other diseases. Similarly, negative emotions were linked to being triggered by gut health issues stemming from too much sugar or caffeine. Having caesareans, and thus not having babies exposed to the healthy bacteria of vaginal birth, were portrayed as negatively influencing a baby’s gut microbiome, exposing them to an increased risk of, for example, obesity, asthma, allergies and diabetes. Regarding antibiotics, it was claimed that they could cause, for example, “irreversible damage to crucial gut bacteria,” or that increasing rates of colorectal cancer were potentially a result of altering the gut microbiome with antibiotics.

Table 2: Most commonly mentioned actions that could be taken to reap microbiome health benefits (n=653)

Actions	# of articles	% of total actions listed (n=983)	# of total articles (n=830)
Food/drink intake	373	37.9	44.9
Take probiotics*	174	17.7	21.0
Avoid certain food/drinks	85	8.6	10.2
Avoid antibiotics	55	5.6	6.6
Fecal transplant	37	3.8	4.5
Avoid caesareans	21	2.1	2.5
Stress Management	21	2.1	2.5
Breastfeeding	19	1.9	2.3
Take prebiotics	18	1.8	2.2
Exercise	16	1.6	1.9
Avoid over-sanitation of house	13	1.3	1.6
General actions	13	1.3	1.6
Avoid alcohol	10	1.0	1.2
Supplements	9	0.9	1.1
Fasting	8	0.8	1.0
Sleep	8	0.8	1.0

Spending time outdoors (incl. dirt play)	7	0.7	0.8
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\*excluding an additional 47 articles where probiotics were portrayed as beneficial without mentioning gut health ideas.

There was a considerably smaller percentage of articles which stated the health benefits or current research related to the microbiome might be unproven, uncertain, ineffective or exaggerated (n=156, 18.8%). Of these 156 articles, nearly half (n=73, 46.8%) critiqued microbiome developments on the grounds of developments or findings being preliminary research, thereby noting that research was still developing and, in some cases, that more evidence would be needed to translate findings into practice. The remaining 83 (53.2% of the critical articles, and 10.0% of the total articles) critiqued ideas around the microbiome more broadly, illustrating a lack of scientific evidence and countering perceived hype around the concepts. There were articles, for example, which referenced studies showing how “adjusting the composition of the microbiome is a complex matter,” articles stating that “probiotics are useless,” articles doubting that autism could be treated with “microbes or pills,” or articles casting doubt on the ability of probiotic-rich yogurt to alter vaginal flora.

There were a few notable distinctions between the articles primarily focused on specific research (n=180, 21.7%) and the remaining articles which did not (n=650, 78.3%). First, as previously mentioned, articles discussing the microbiome in the context of babies/children constituted 25.6% of articles focused on research, but were present in only 8.3% of other articles not specifically focused on research. Both research-focused articles and more general articles described health benefits in relation to the microbiome with similar frequency (90.6% and 87.5% respectively), and non-research-specific articles detailed microbiome-related actions (80.9%) only slightly more often than research-focused articles (70.6%). Research specific articles, however, discussed critical perspectives of the microbiome (30.0%) approximately twice as often as general articles (15.7%).

Discussion

The findings from this research demonstrate the presence of microbiome hype<sup>3,25,30</sup> in the popular press of American and Canadian audiences. The overwhelming majority of articles (93.8%) either describe health benefits associated with the microbiome or list health benefits associated with taking probiotics. When detailing health benefits, the vast majority of these articles (89.2%) list actions that can be taken to obtain these claimed benefits. As there is demonstrable public interest in the relationship of the microbiome to one’s health, and with considerable interesting research underway, it is unsurprising that numerous health benefits are detailed in articles. Still, a weakness in the way this science is being communicated is the fact that less than 19% of the articles suggest that current microbiome science or applications are unproven, ineffective, exaggerated, or requiring more research. This occurs with even less frequency in general articles where the central focus is not detailing specific research. And, as noted in the introduction, despite the abundance of promising research, there are still few microbiome-related clinical applications ready for use.

This research finds the popular press portraying the microbiome as influential in over 135 health conditions/diseases including, digestive issues, obesity, cancer, allergies, skin health, diabetes, asthma, irritable bowel syndrome, and a range of mental health topics including depression, mood, “brain health”, as well as behaviour and ADHD in children. It was linked to discussions of colds,

headaches, health during pregnancy, tooth decay, blood circulation, jet lag, eating disorders, sleep, menopause, dementia and athletic performance. *Clostridium difficile*, one of the few ailments for which microbiome treatments are in practice (specifically faecal microbiota transplant or FMT) and supported by evidence<sup>42</sup> is also discussed, but only in a small number of articles (3.5%).

Most often, the benefits of a “healthy gut” are simply presented as a given. Certain foods (e.g., yogurt, kombucha) and particular practices (e.g., taking probiotics) are presented as being beneficial to “gut health,” though typically no details are provided (e.g. research showing benefit in some contexts<sup>28</sup>) about why this is so or what the particular health benefits might be. In this regard, the ideas around the microbiome, particularly when expressed as “gut health,” appear oversimplified and function like rhetorical products, signaling and bolstering the microbiome trend, generating attention, attracting readers, and promoting products. This phenomenon, sometimes referred to as a “health halo,”<sup>43</sup> has been similarly observed in other topics like “immune boosting”<sup>31</sup> and in other research on portrayals of the microbiome in the media.<sup>4</sup>

Actions most commonly described to reap the health benefits associated with the microbiome typically focused on lifestyle topics, including nutrition, stress management, general actions (“maintaining”, “strengthening”, “balancing”, “boosting”, etc.), exercise, and sleep. Additionally, health benefits associated with probiotic intake had a large presence in the data set, in 27% of all articles. It was common in these contexts, as well as when promoting fecal transplants and breastfeeding or when problematizing the impact of antibiotic use on the microbiome, to highlight research or take quotes from health care professionals. Research of this precise nature is being conducted in numerous institutions, whereby fecal transplants are showing signs of effectiveness in particular circumstances,<sup>32</sup> and antibiotic intake can negatively influence the microbiome.<sup>44,45,46,47</sup> Further, some lifestyle activities, such as nutrition can play a role in altering the microbiome even though accurately determining the impact remains a challenge.<sup>48,49</sup> In sum, however, while the articles often mention research projects and quote scientists and healthcare practitioners, the overall portrayal of the microbiome science appears to be either oversimplified or greatly exaggerated, serving instead as a means to promote and validate the lifestyle ideas and products contained in the articles. Indeed, less than 19% of all articles provided any critique of the microbiome, with general articles doing so even less frequently (15.7%) than articles focused on specific research developments (30.0%).

Further, in cases where a critique was evident, nearly half (46.8%) portrayed limitations to the microbiome as being simply a case of preliminary research, which may or may not influence how the diverse readership of the popular press interpret the realistic state of the scientific developments.<sup>50,51,52, 53,54</sup> Specifically, it may give a false impression of a potential applications’ readiness, for example, in cases of the microbiome’s influence on autism or mental health.<sup>4</sup> The hyping of science, however, typically involves numerous participants<sup>21,48</sup> and it is therefore misguided to isolate singular actors as the propagators of information distortion such as the authors of the articles in the popular press. Indeed, extensive research has shown how information dissemination through social media creates an abundance of information accuracy challenges.<sup>55,56,57,58</sup>

## Limitations

This study was limited in its ability to capture and analyze all of the microbiome discourse relevant to audiences. Covering the popular press’s portrayal of the microbiome during a period when the topic was popular has provided insights into how microbiome science is being communicated. Future research could replicate this study in other regions to see whether the same trend persists or whether some press sources, in some contexts, portray the microbiome in significantly different manners. Additionally, other research projects could explore whether these portrayals are similar or different on popular social media platforms such as Instagram, Twitter, or TikTok.

Conclusion

Microbiome articles published for North American audiences typically popularize gut health trends while only offering a little in the way of communicating the science. It is promising to see cases where some complexities of the research were presented alongside ongoing applications, but the overall number of articles which did this were few. The ongoing communication of accurate science will require a more concerted effort from all of those involved in the process.

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**Footnotes**

**Acknowledgements**

The authors thank Mark Bieber, Carly Giles, Allison Jandura, Charisse Petersen, and Robyn Hyde-Lay for their assistance in the project.

**Contributors:** ARM and TC designed the study with input from SET. ARM collected the data and performed the analysis. ARM and TC interpreted the data. ARM, TC, and SET were involved in drafting and revising the manuscript. All authors approved the final version to be published and agreed to be accountable for all aspects of the work.

**Funding:** The authors would like to thank Genome Canada, Genome Alberta, and the Canadian Institutes for Health Research for their generous support of Childhood asthma and the microbiome – precision health for life: The Canadian Healthy Infant Longitudinal Development (CHILD) study (#274CHI).

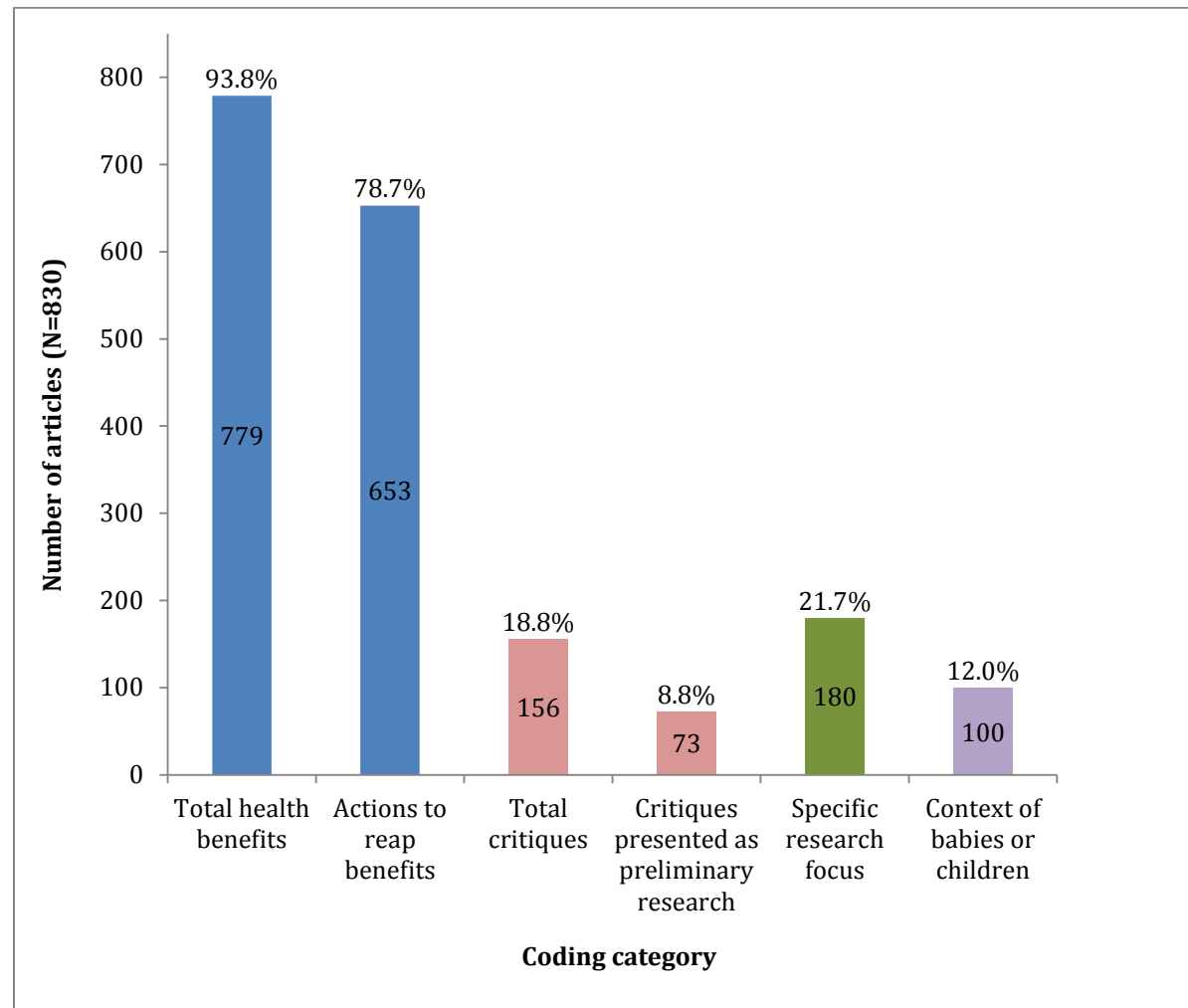
**Competing interests** None to declare.

**Patient consent for publication** Not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.

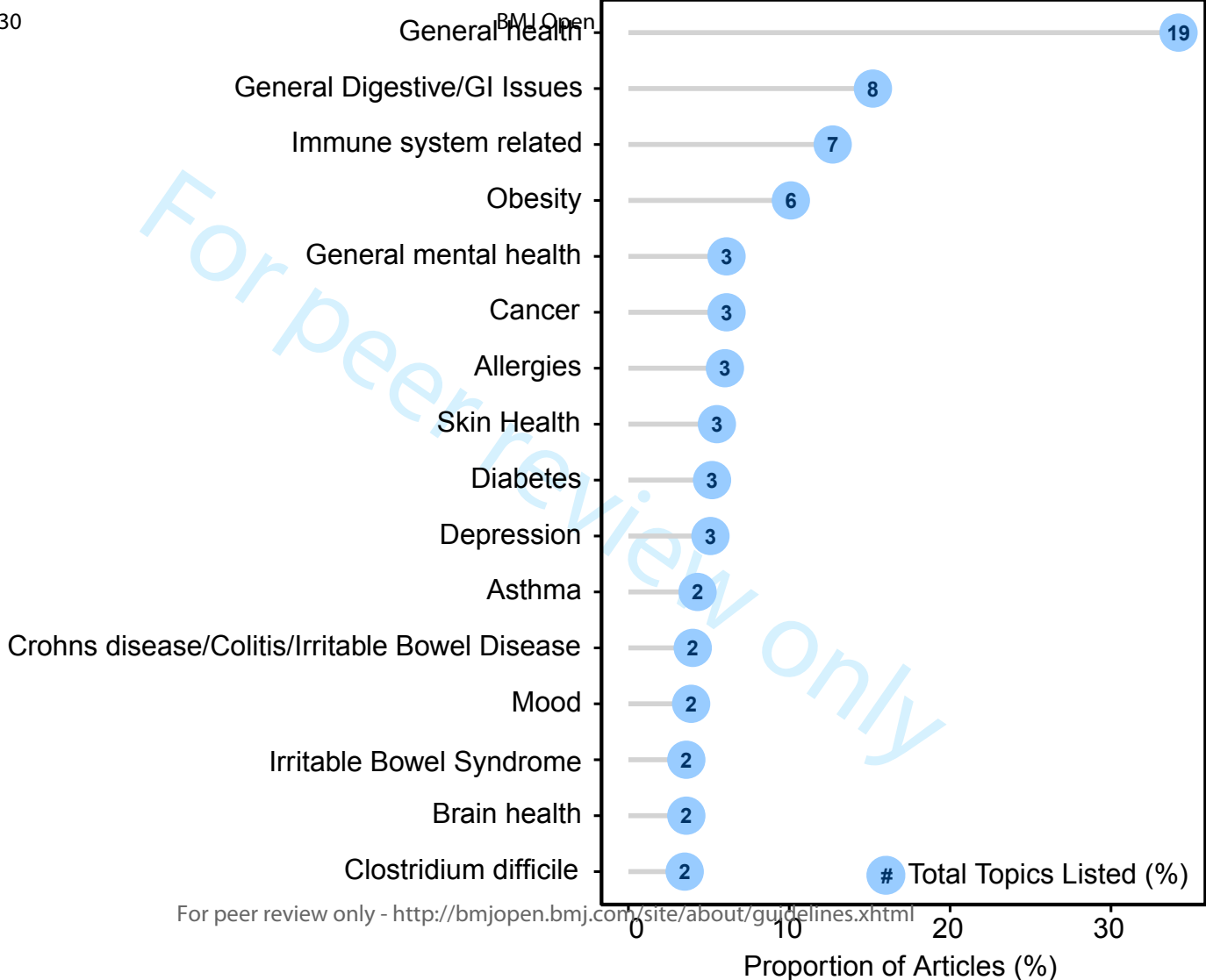
**Data availability statement** Data are available in a public, open access repository. The data set is available at: [10.6084/m9.figshare.14410310](https://doi.org/10.6084/m9.figshare.14410310)

Figure 1: Microbiome benefits, critiques, research focus and baby/child focus in press articles popular among Canadian and American audiences (N=830)



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Top Health Topics (2% or greater proportion)



## Top Health Actions for Microbiome Health Benefits



Supplementary Materials

FACTIVA search summary

Search Summary	
Text	"gut health" or "healthy gut" or "unhealthy gut" or "gut bacteria" or "microbiota" or "microbiome" or "probiotic" or "probiotics"
Date	01/01/2018 to 10/11/2019
Source	USA Today - All sources Or Los Angeles Times - All sources Or The New York Times - All sources Or Houston Chronicle - All sources Or Chicago Tribune - All sources Or Tampa Bay Times (Fla.) Or Washington Post - All sources Or Newsday (N.Y.) Or New York Post - All sources Or The Dallas Morning News Or The Dallas Morning News Or New York Daily News Or Denver Post - All sources Or The Boston Globe - All sources Or The Seattle Times - All sources Or AM New York Or Star-Tribune (Minneapolis-St. Paul) Or Star-Tribune (Minneapolis-St. Paul) Or The Guardian (U.K.) Or The Telegraph (U.K.) - All sources Or Mirror.co.uk (U.K.) Or Independent Online (U.K.) Or Detroit Free Press - All sources Or The Washington Times Or The Washington Times Or The Oregonian - All sources Or The Times-Picayune Web Edition (New Orleans) Or Orlando Sentinel - All sources Or The Las Vegas Review-Journal Or The Las Vegas Review-Journal Or The Atlanta Journal - Constitution Or Honolulu Star-Advertiser Or Honolulu Star-Advertiser Or The Fort Worth Star-Telegram (Texas) Or Columbus Dispatch - All sources Or The Philadelphia Inquirer Or Worcester Telegram & Gazette (Mass.) Or The Denver Post (Colo.) Or The Buffalo News - All sources Or The San Francisco Chronicle - All sources Or St. Paul Pioneer Press (Minn.) Or The Plain Dealer (Cleveland) Or San Diego Union-Tribune Or The Orange County Register (Calif.) Or The Star-Ledger (Newark, N.J.) Or The Arizona Republic (Phoenix) Or Metro - New York Or MSNBC Network - All sources Or ESPN Or CNN - All sources Or Fox News - All sources Or BBC - All sources Or HuffPost Or HuffPost Canada Or BuzzFeed Or Forbes.com Or NBC Network - All sources Or NPR - All Things Considered Or NPR - Morning Edition Or NPR - News Special Or NPR - Weekend All Things Considered Or NPR - Weekend Edition - Saturday Or NPR - Weekend Edition - Sunday Or CBS Network - All sources Or Breitbart News Network Or The Hill (U.S.) Or ABC Network - All sources Or Politico Or Gizmodo Or MarketWatch Or The Daily Beast Or Seeking Alpha Or The Verge Or The Globe and Mail - All sources Or National Post (Canada) Or The Toronto Sun Or The Toronto Star Or Montreal Gazette Or Vancouver Province (British Columbia) Or Vancouver Sun (British Columbia) Or Ottawa Citizen Or The Ottawa Sun (Ontario) Or Calgary Herald (Alberta) Or The Calgary Sun (Alberta) Or Edmonton Journal (Alberta) Or The Edmonton Sun (Alberta) Or Winnipeg Free Press (Manitoba) Or The Winnipeg Sun (Manitoba) Or The Hamilton Spectator (Ontario) Or The London Free Press (Ontario) Or Waterloo Region Record (Ontario) Or Chronicle Herald (Nova Scotia) Or Niagara Falls Review (Ontario) Or Victoria Times Colonist (Vancouver, British Columbia) Or Windsor Star (Ontario) Or Saskatoon Star Phoenix (Saskatchewan) Or Regina Leader Post (Saskatchewan) Or The Telegram (Newfoundland) Or Daily Mail (U.K.) Or The Wall Street Journal Or The Wall Street Journal Online Or Business Insider (U.S.) Or Reuters News Or Reuters Health E-Line
Author	All Authors
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Sources and count table

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Edmonton Journal	CAN	2
Montreal Gazette	CAN	13
National Post	CAN	2
Regina Leader Post	CAN	1
Saskatoon Star Phoenix	CAN	1
The Globe and Mail	CAN	27
The Hamilton Spectator	CAN	30
The London Free Press	CAN	2
The Ottawa Sun	CAN	2
The Toronto Star	CAN	11
The Toronto Sun	CAN	3
The Winnipeg Sun	CAN	1
Vancouver Province	CAN	5
Vancouver Sun	CAN	6
Victoria Times Colonist	CAN	15
Waterloo Region Record	CAN	4
Winnipeg Free Press	CAN	6
Daily Mail	UK	82
Independent Online	UK	53
Mirror.co.uk	UK	68
Telegraph	UK	170
The Guardian	UK	70
Business Insider	USA	16
CBS News: Evening News	USA	1
CNN Wire	USA	20
Forbes.com	USA	7
MarketWatch	USA	4
New York Daily News	USA	1
New York Post	USA	19

New York Times	USA	21	
Reuters News	USA	23	
Star-Tribune	USA	13	
Tampa Bay Times	USA	7	
The Atlanta Journal - Constitution	USA	4	
The Boston Globe	USA	17	
The New York Times	USA	30	
The Philadelphia Inquirer	USA	10	
The Wall Street Journal	USA	13	
The Washington Post	USA	33	
USA Today	USA	5	
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	USA	18	
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TOTALS	CAN	143	17.2%
	USA	244	29.4%
	UK	443	53.4%
		830	100.0%

\*with a large number of articles coming from one source (The Telegraph), analysis was conducted to conclude that the singular source was not displaying a trend of findings different from that of the remaining sources

Gut Health/Microbiome Coding Frame      October 2019 / HLI, University of Alberta

#### Overview coding for context

1. Choose1: Is the article Relevant or Irrelevant? (Irrelevant articles include: one of the search terms appearing in text with no supporting text or elaboration; transcripts of radio or tv shows; one of the search terms used solely in the context of animal health; duplicate of previously read article)
2. Is the article's main focus highlighting research? Yes/No
3. Does the article include a discussion of babies/children in relation to gut health (including all search terms included)?

#### Principle content coding

1. Does the article make claims of health benefits related to gut health (gut bacteria), probiotics, or the microbiome (microbiota)? Yes/No
  - 1b. If yes in #1, what health benefits are listed? [choose all that apply – always code a specific benefit if possible before coding for a more general category]

- Brain health (memory, learning, cognitive abilities, etc.)
- General health (no specific items listed but seen as valuable for health, and also, general phrasing such as “optimal gut health”; “optimal health”; “improve wellness”; “manage stress”, “good wellbeing, etc.)
- General mental health (“mental health”, but no specifics mentioned, etc.)
- General Digestive/GI Issues (bloating, gas (flatulence), diarrhea, acid reflux, leaky gut also “aiding”, “helping with”, etc.)
- Skin health (including cosmetic and more serious issues like eczema, psoriasis or other forms of dermatitis)
- Allergies
- Alzheimer’s disease
- Anorexia
- Anxiety
- Arthritis
- Behaviour (children)
- Cancer
- Clostridium difficile (C. diff)
- Colds (“common colds”, etc.)
- Colic
- Crohn’s disease/Colitis/Irritable Bowel Disease
- Dementia
- Depression
- Diabetes
- Energy related (including fatigue, and Chronic Fatigue Syndrome (CFS))
- Fibromyalgia
- Headaches
- Heart related (including heart disease and artery issues)
- Immune system related (“boosting”, improving, fighting off infection, etc.)
- Irritable Bowel Syndrome (IBS)
- Menopause (including hormonal imbalances)
- Mood (improving)
- Multiple Sclerosis
- Obesity (including weight management (weight loss, etc.)
- Oral disease
- Parkinson’s disease
- Pain (including chronic pain, joint pain)
- Pharmaceutical drug development
- Pharmaceutical drug metabolizing
- Pregnancy health (including avoiding premature delivery)
- Other [fill in]

2. Does the article provide information (actions one can take) regarding how an individual can reap benefits related to gut health (gut bacteria), probiotics, or the microbiome (microbiota)? Yes/No

2b) If yes in #2, what actions are mentioned? [list] (e.g. eating certain foods, fecal transplants, etc.)?  
[choose all that apply]

- Food/drink intake (including fostering diversity, and eating schedule/advice related to food timing, chewing, etc.)
- Avoiding certain food/drinks
- Breastfeeding
- Take probiotics
- Take prebiotics
- General actions (“monitor”, “look after”; “take care of”, etc.)
- Avoid antibiotics
- Avoid caesareans (including be wary of; benefits lost if, etc.)
- Avoid over-sanitation of house (including avoiding chemicals in cleaning products)
- Avoid smoking (including stop smoking)
- Exercise
- Fecal transplant (including pills (i.e. “poop pills”))
- Massage
- Sinus microbiome transplant
- Sleep related (get more, get better, etc.)
- Weight management (“control”, etc.)
- Yoga
- Vaginal seeding
- Other [fill in]

3. Does the article state, in any form, that the benefits or current research related to gut health (gut bacteria), probiotics, or the microbiome (microbiota) might be unproven, ineffective or exaggerated? Yes/No

3a) If yes, is this rhetoric described as “(only) preliminary research”, “developing research”, “early stage research”, etc.

4. (ADDITION TO #1, attached to coding platform) Does the article portray probiotics as beneficial without making links to ideas of the microbiome/gut health? Yes/No

#### Complete list of Health Topics

	Health topics	# of articles	(n=732)	n=830	1502
1	General health	284	38.8%	34.2%	18.91%
2	General Digestive/GI Issues	126	17.2%	15.2%	8.39%
3	Immune system related	105	14.3%	12.7%	6.99%
4	Obesity	84	11.5%	10.1%	5.59%
5	Cancer	51	7.0%	6.1%	3.40%
6	General mental health	51	7.0%	6.1%	3.40%
7	Allergies	50	6.8%	6.0%	3.33%
8	Skin Health	46	6.3%	5.5%	3.06%
9	Diabetes	43	5.9%	5.2%	2.86%

1	10	Depression	42	5.7%	5.1%	2.80%
2	11	Asthma	36	4.9%	4.3%	2.40%
3	12	Crohn's disease/Colitis/Irritable Bowel Disease	33	4.5%	4.0%	2.20%
4	13	Mood	32	4.4%	3.9%	2.13%
5	14	Brain health	30	4.1%	3.6%	2.00%
6	15	Irritable Bowel Syndrome	30	4.1%	3.6%	2.00%
7	16	Clostridium difficile	29	4.0%	3.5%	1.93%
8	17	Inflammation	26	3.6%	3.1%	1.73%
9	18	Anxiety	24	3.3%	2.9%	1.60%
10	19	Inflammatory Bowel Disease	21	2.9%	2.5%	1.40%
11	20	Heart related	18	2.5%	2.2%	1.20%
12	21	Alzheimers disease	15	2.0%	1.8%	1.00%
13	22	Energy related	14	1.9%	1.7%	0.93%
14	23	Parkinsons disease	14	1.9%	1.7%	0.93%
15	24	Autism	12	1.6%	1.4%	0.80%
16	25	Metabolism	11	1.5%	1.3%	0.73%
17	26	Metabolic Disorder	10	1.4%	1.2%	0.67%
18	27	Autoimmune Diseases (disorders)	9	1.2%	1.1%	0.60%
19	28	Diarrhea	9	1.2%	1.1%	0.60%
20	29	Intestinal Permeability (leaky gut)	9	1.2%	1.1%	0.60%
21	30	Sleep	9	1.2%	1.1%	0.60%
22	31	Weight management	9	1.2%	1.1%	0.60%
23	32	Dementia	8	1.1%	1.0%	0.53%
24	33	Menopause	8	1.1%	1.0%	0.53%
25	34	Multiple Sclerosis	7	1.0%	0.8%	0.47%
26	35	Stress	7	1.0%	0.8%	0.47%
27	36	Athletic Performance/Recovery	6	0.8%	0.7%	0.40%
28	37	Liver Disease	6	0.8%	0.7%	0.40%
29	38	Vitamin Absorption	6	0.8%	0.7%	0.40%
30	39	Antibiotic resistance (and recovery)	5	0.7%	0.6%	0.33%
31	40	Arthritis	5	0.7%	0.6%	0.33%
32	41	Metabolic Syndrome	5	0.7%	0.6%	0.33%
33	42	Constipation	4	0.5%	0.5%	0.27%
34	43	Diverticulitis	4	0.5%	0.5%	0.27%
35	44	Eczema in Children	4	0.5%	0.5%	0.27%
36	45	ADHD	3	0.4%	0.4%	0.20%

1	46	Appetite	3	0.4%	0.4%	0.20%
2	47	Bipolar Disorder	3	0.4%	0.4%	0.20%
3	48	cardiovascular disease	3	0.4%	0.4%	0.20%
4	49	Colds	3	0.4%	0.4%	0.20%
5	50	Headaches	3	0.4%	0.4%	0.20%
6	51	Influenza	3	0.4%	0.4%	0.20%
7	52	Lyme Disease	3	0.4%	0.4%	0.20%
8	53	Oral Hygiene	3	0.4%	0.4%	0.20%
9	54	PKU	3	0.4%	0.4%	0.20%
10	55	Pregnancy health	3	0.4%	0.4%	0.20%
11	56	Preventative measures (disease)	3	0.4%	0.4%	0.20%
12	57	Tooth decay	3	0.4%	0.4%	0.20%
13	58	Vaginal issues	3	0.4%	0.4%	0.20%
14	59	Aging	2	0.3%	0.2%	0.13%
15	60	Behaviour	2	0.3%	0.2%	0.13%
16	61	Blood circulation	2	0.3%	0.2%	0.13%
17	62	Bone Health (density)	2	0.3%	0.2%	0.13%
18	63	Cholesterol	2	0.3%	0.2%	0.13%
19	64	Eating disorders	2	0.3%	0.2%	0.13%
20	65	E-coli	2	0.3%	0.2%	0.13%
21	66	Fibromyalgia	2	0.3%	0.2%	0.13%
22	67	Gene Activity	2	0.3%	0.2%	0.13%
23	68	General Beauty and Apperance	2	0.3%	0.2%	0.13%
24	69	HIV	2	0.3%	0.2%	0.13%
25	70	Immunity	2	0.3%	0.2%	0.13%
26	71	Infections (general)	2	0.3%	0.2%	0.13%
27	72	Jet lag	2	0.3%	0.2%	0.13%
28	73	Migraine	2	0.3%	0.2%	0.13%
29	74	Motor Nueron Disease	2	0.3%	0.2%	0.13%
30	75	Oral disease	2	0.3%	0.2%	0.13%
31	76	Pain	2	0.3%	0.2%	0.13%
32	77	Seratonin Levels	2	0.3%	0.2%	0.13%
33	78	ulcers	2	0.3%	0.2%	0.13%
34	79	Urea Cycle Disorders	2	0.3%	0.2%	0.13%
35	80	Urinary Tract Infections	2	0.3%	0.2%	0.13%
36	81	Polycystic Ovary Syndrome	2	0.3%	0.2%	0.13%

1	82	Alcohol Cravings	1	0.1%	0.1%	0.07%
2	83	Anemia	1	0.1%	0.1%	0.07%
3						
4	84	Antioxidant Status	1	0.1%	0.1%	0.07%
5	85	Appendicitis	1	0.1%	0.1%	0.07%
6						
7	86	Appetite	1	0.1%	0.1%	0.07%
8						
9	87	artery health	1	0.1%	0.1%	0.07%
10	88	bloodstream infections	1	0.1%	0.1%	0.07%
11						
12	89	Celiac Disease	1	0.1%	0.1%	0.07%
13						
14	90	Chemotherapy Recovery	1	0.1%	0.1%	0.07%
15	91	Childhood Development	1	0.1%	0.1%	0.07%
16						
17	92	Cholera	1	0.1%	0.1%	0.07%
18						
19	93	Cognitive Disorder	1	0.1%	0.1%	0.07%
20	94	Dental Health/Gingivitis	1	0.1%	0.1%	0.07%
21						
22	95	Emotional Responses	1	0.1%	0.1%	0.07%
23	96	Flu vaccine effectiveness	1	0.1%	0.1%	0.07%
24						
25	97	Gluten Intolerances	1	0.1%	0.1%	0.07%
26						
27	98	Glycemic Control	1	0.1%	0.1%	0.07%
28						
29	99	Gonorrhoea	1	0.1%	0.1%	0.07%
30	100	Gum Disease	1	0.1%	0.1%	0.07%
31						
32	101	H. Pylori Eradication	1	0.1%	0.1%	0.07%
33	102	Hair loss	1	0.1%	0.1%	0.07%
34						
35	103	Hairy tongue	1	0.1%	0.1%	0.07%
36						
37	104	Healing system	1	0.1%	0.1%	0.07%
38	105	Heartburn	1	0.1%	0.1%	0.07%
39						
40	106	Hepatic Encephalopathy	1	0.1%	0.1%	0.07%
41	107	Hormonal Bloating	1	0.1%	0.1%	0.07%
42						
43	108	Hyperammonemia	1	0.1%	0.1%	0.07%
44						
45	109	Hypertension	1	0.1%	0.1%	0.07%
46	110	Improve focus	1	0.1%	0.1%	0.07%
47						
48	111	Infant Breastfeeding	1	0.1%	0.1%	0.07%
49	112	Infertility	1	0.1%	0.1%	0.07%
50						
51	113	Interstitial Cystitis	1	0.1%	0.1%	0.07%
52						
53	114	Iron Deficiency	1	0.1%	0.1%	0.07%
54	115	Kidney Disease	1	0.1%	0.1%	0.07%
55						
56	116	Kidney Stones	1	0.1%	0.1%	0.07%
57						
58	117	Medication Rashes	1	0.1%	0.1%	0.07%

118	Melanoma	1	0.1%	0.1%	0.07%
119	Menstrual health	1	0.1%	0.1%	0.07%
120	motor neurone disease	1	0.1%	0.1%	0.07%
121	Mucus Colitis	1	0.1%	0.1%	0.07%
122	Nervous system related	1	0.1%	0.1%	0.07%
123	Osteoarthritis	1	0.1%	0.1%	0.07%
124	Osteoporosis	1	0.1%	0.1%	0.07%
125	Pharmaceutical drug development	1	0.1%	0.1%	0.07%
126	Pharmaceutical drug metabolizing	1	0.1%	0.1%	0.07%
127	phenylketonuria	1	0.1%	0.1%	0.07%
128	Pneumonia	1	0.1%	0.1%	0.07%
129	Pouchitis	1	0.1%	0.1%	0.07%
130	Premature Births	1	0.1%	0.1%	0.07%
131	psoriasis	1	0.1%	0.1%	0.07%
132	rehab	1	0.1%	0.1%	0.07%
133	Respiratory infections	1	0.1%	0.1%	0.07%
134	Schizophrenia	1	0.1%	0.1%	0.07%
135	Sore Tongue	1	0.1%	0.1%	0.07%
136	Thyroid Condition	1	0.1%	0.1%	0.07%
137	Transplant Success	1	0.1%	0.1%	0.07%
138	UTIs	1	0.1%	0.1%	0.07%

### Complete list of actions

	Health Action	# articles	out of 653 articles with actions	830	983
1	Food/drink intake	373	57.1%	44.9%	37.9%
2	Take probiotics	174	26.6%	21.0%	17.7%
3	Avoiding certain food/drinks	85	13.0%	10.2%	8.6%
4	Avoid antibiotics	55	8.4%	6.6%	5.6%
5	Fecal transplant	37	5.7%	4.5%	3.8%
6	Avoid caesareans	21	3.2%	2.5%	2.1%
7	Stress Management	21	3.2%	2.5%	2.1%
8	Breastfeeding	19	2.9%	2.3%	1.9%
9	Take prebiotics	18	2.8%	2.2%	1.8%
10	Exercise	16	2.5%	1.9%	1.6%
11	Avoid over-sanitation of house	13	2.0%	1.6%	1.3%
12	General actions	13	2.0%	1.6%	1.3%
13	Avoid alcohol	10	1.5%	1.2%	1.0%
14	Supplements	9	1.4%	1.1%	0.9%
15	Fasting	8	1.2%	1.0%	0.8%

16	Sleep	8	1.2%	1.0%	0.8%
17	Spending time outdoors (+ dirt play)	7	1.1%	0.8%	0.7%
18	Medications	5	0.8%	0.6%	0.5%
19	Yoga	4	0.6%	0.5%	0.4%
20	Avoid acid-suppressing drugs	3	0.5%	0.4%	0.3%
21	Colonics	3	0.5%	0.4%	0.3%
22	Detoxes	3	0.5%	0.4%	0.3%
23	Avoid Pollution	2	0.3%	0.2%	0.2%
24	Avoid proton-pump inhibitors	2	0.3%	0.2%	0.2%
25	bacteriophages	2	0.3%	0.2%	0.2%
26	Medication Research and Development	2	0.3%	0.2%	0.2%
27	Raw water	2	0.3%	0.2%	0.2%
28	Use Eco-Friendly Household Cleaners	2	0.3%	0.2%	0.2%
29	Mayr Method	2	0.3%	0.2%	0.2%
30	Personalized diet	2	0.3%	0.2%	0.2%
31	Vaginal Seeding	2	0.3%	0.2%	0.2%
32	Monitor poo (and schedule)	2	0.3%	0.2%	0.2%
33	Avoid Stomach Acid Blockers	2	0.3%	0.2%	0.2%
34	Gut Health Clinics	2	0.3%	0.2%	0.2%
35	Eat breakfast	2	0.3%	0.2%	0.2%
36	Eat slowly	1	0.2%	0.1%	0.1%
37	Hydration	1	0.2%	0.1%	0.1%
38	IV/Drip therapy	1	0.2%	0.1%	0.1%
39	Vaginal Birth	1	0.2%	0.1%	0.1%
40	CBD Oil	1	0.2%	0.1%	0.1%
41	Adult Consumption of Breast Milk	1	0.2%	0.1%	0.1%
42	Pilates	1	0.2%	0.1%	0.1%
43	Liver Treatments	1	0.2%	0.1%	0.1%
44	Animal Saliva	1	0.2%	0.1%	0.1%
45	Anti-microbials	1	0.2%	0.1%	0.1%
46	Appendix Removal	1	0.2%	0.1%	0.1%
47	Peppermint Oil	1	0.2%	0.1%	0.1%
48	Avoid Childhood Vaccination	1	0.2%	0.1%	0.1%
49	Avoid Endocrine Disruptor Exposure	1	0.2%	0.1%	0.1%
50	Avoid Giving Infants Scented Baths	1	0.2%	0.1%	0.1%
51	Avoid glyphosate fertilizers	1	0.2%	0.1%	0.1%
52	Avoid Herbicide Exposure	1	0.2%	0.1%	0.1%
53	Avoid intense scrubbing, shaving, waxing and exposure to sun (skin)	1	0.2%	0.1%	0.1%
54	Avoid Limiting Transmission of Maternal Microbiota	1	0.2%	0.1%	0.1%
55	Avoid Mouthwash	1	0.2%	0.1%	0.1%
56	Avoid NSAID painkillers	1	0.2%	0.1%	0.1%
57	Avoid smoking	1	0.2%	0.1%	0.1%
58	Avoid taking opioids for long periods of time	1	0.2%	0.1%	0.1%
59	Hormones	1	0.2%	0.1%	0.1%
60	Azithromycin use	1	0.2%	0.1%	0.1%
61	Bioengineered Bacteria	1	0.2%	0.1%	0.1%
62	City stop spraying glyphosate in city parks	1	0.2%	0.1%	0.1%

63	Colon Cancer Screening	1	0.2%	0.1%	0.1%
64	Cryotherapy	1	0.2%	0.1%	0.1%
65	Drugs Containing Human Gut Microbes	1	0.2%	0.1%	0.1%
66	E. Coli Derivative	1	0.2%	0.1%	0.1%
67	Electrical Stimulation of the Vagus Nerve	1	0.2%	0.1%	0.1%
68	Engineered Genes	1	0.2%	0.1%	0.1%
69	Eradicate Gut Health Following Cardiac Arrest	1	0.2%	0.1%	0.1%
70	Freeze-Dried Healthy Gut Bacteria	1	0.2%	0.1%	0.1%
71	Skin-to-Skin Contact Between Mother and Baby	1	0.2%	0.1%	0.1%
72	Gardening	1	0.2%	0.1%	0.1%
73	Gargling and Singing Loudly	1	0.2%	0.1%	0.1%
74	Gratitude Journaling,	1	0.2%	0.1%	0.1%
75	Hormonal Therapy	1	0.2%	0.1%	0.1%
76	Injecting Antibiotics Rather than Ingesting Them	1	0.2%	0.1%	0.1%
77	Interactions with Other Children	1	0.2%	0.1%	0.1%
78	Intestinal Absorbent (Enterogel)	1	0.2%	0.1%	0.1%
79	Lower glycemic load	1	0.2%	0.1%	0.1%
80	microbiome drug	1	0.2%	0.1%	0.1%
81	migration	1	0.2%	0.1%	0.1%
82	more holistic approach to health	1	0.2%	0.1%	0.1%
83	Psychobiotics	1	0.2%	0.1%	0.1%
84	Relationships	1	0.2%	0.1%	0.1%
85	Sinus microbiome transplant	1	0.2%	0.1%	0.1%
86	treatments, diagnostic testing	1	0.2%	0.1%	0.1%
87	Use of probiotic cleaning	1	0.2%	0.1%	0.1%

Standards for Reporting Qualitative Research (SRQR)\*

<http://www.equator-network.org/reporting-guidelines/srqr/>

Page/line no(s).

Title and abstract

<b>Title</b> - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	Page 2/ 7,8
<b>Abstract</b> - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	Page 3/ 7-51

Introduction

<b>Problem formulation</b> - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	Page 4/ 20-56
<b>Purpose or research question</b> - Purpose of the study and specific objectives or questions	Page 5/3-10

Methods

<b>Qualitative approach and research paradigm</b> - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	Page 5/13-28
<b>Researcher characteristics and reflexivity</b> - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	Page 6/3-11
<b>Context</b> - Setting/site and salient contextual factors; rationale**	Page 5/15-26
<b>Sampling strategy</b> - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	Page/16-24
<b>Ethical issues pertaining to human subjects</b> - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	n/a
<b>Data collection methods</b> - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	Page 5/15-24

<b>Data collection instruments and technologies</b> - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	Page 5/16--17
<b>Units of study</b> - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	Page 5/31, 54-55
<b>Data processing</b> - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	Page 5/16-21
<b>Data analysis</b> - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	Page 5/31-52
<b>Techniques to enhance trustworthiness</b> - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	Page 6/6-11

## Results/findings

<b>Synthesis and interpretation</b> - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	Pages 6-9/all lines (page 9/1-25)
<b>Links to empirical data</b> - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	Pages 6-9/throughout

## Discussion

<b>Integration with prior work, implications, transferability, and contribution(s) to the field</b> - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	Page 9/28-56, Page 10/3-46
<b>Limitations</b> - Trustworthiness and limitations of findings	Page 4/ 7-14 Page 10/50-56

## Other

<b>Conflicts of interest</b> - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	Page 14/30
<b>Funding</b> - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	Page 14/24-28

\*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

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\*\*The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

**Reference:**  
O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014  
DOI: 10.1097/ACM.0000000000000388

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